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Improved Drill Presses.

On this and the succeeding page we give illustrations of the latest improvements which have been introduced in their line of drill presses by Gould & Eberhardt, of Newark, N. J.

Figs. 1 and 2 show the press, with tapping attachment, which consists of an extra spindle driven by a spur gear from the main spindle, and so arranged that when a hole has been drilled the work is simply shifted over under the tapping spindle, which has a vertical movement, by counterbalanced lever and a double clutch for reversing the motion, as has been previously explained. Fig. 1 also has a compound table, which, in addition to the two slides at right angles to each other, can be swiveled completely around by worm gearing in the supporting arm, so that any desired movement of the table can be obtained, either for setting the work or for cutting operations, these machines being made with bearings and other features fitting them for milling or profiling operations where desired.

The most notable improvement in the machine, however, is found in the method adopted of giving vertical motion to the arm supporting the table. A large screw is placed forward of the main column, so that it comes about under the center of the weight. The screw rests in a plate, or socket, which is on the bed-plate, and the bevel gear shown is threaded to fit it, motion being imparted by the shaft and bevel pinion as shown. This not only makes a very convenient method of moving the table up or down, but the rigidity of the machine when doing heavy work is very much increased, as it will be evident that it must be.

At Fig. 2 is a machine which has a table with the two slides at right angles, and the same means of raising and lowering, but without the swivel. This machine is especially fitted up for use in out of the way places, where drill presses are sometimes required to be used, and, with this in view, has at the back, between the two upright members of the frame, a cupboard fitted up with back and door of latticed work in iron, the door being provided with a good lock, and the cupboard with shelves having provision for holding a full complement of drills and other tools used about the machine.

On a bracket attached to the frame at the right is placed a twist drill grinder, made at the Worcester Polytechnic Institute machine shops, and illustrated by us September 15, '88. It is driven from the pulley seen above, and, thus equipped, the man operating the machine is prepared to do almost any work that may come along, without the necessity for leaving to go to tool-room or grinder.

Fig. 3 (page 2) shows the regular drill press with improved supporting arm for table, but without the other special features, while Fig. 4 shows it with the addition of two friction clutches and driving pulleys at the back, which may be used either for getting two different speeds or for reversing the motion when heavy tapping is to be done above the capacity of the tapping attachment.

Of course any desired combination of these special features can be made upon any machine, and thus the best possible adaptation to the work to be done can be secured.

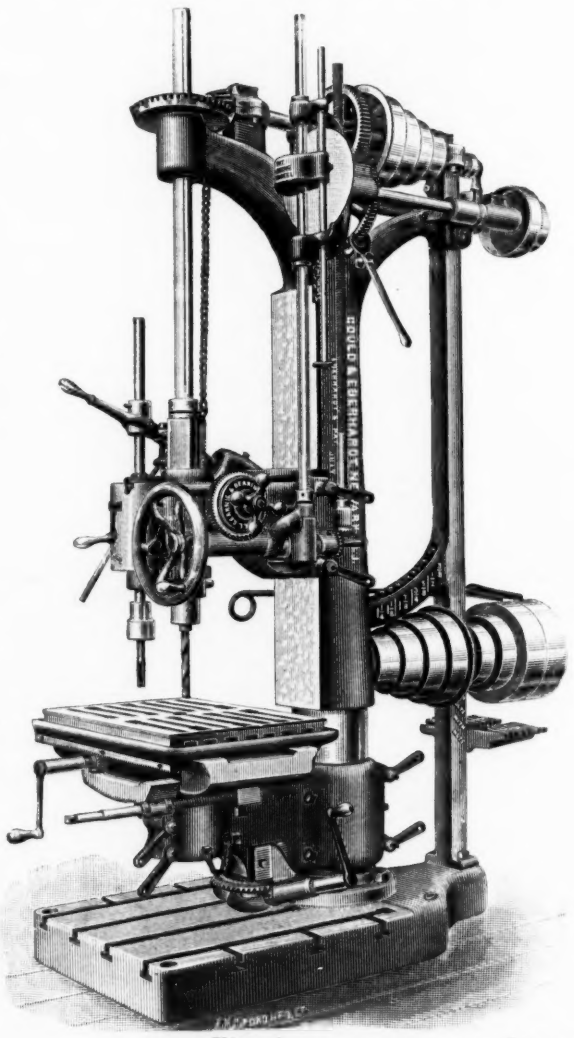


Fig. 1.

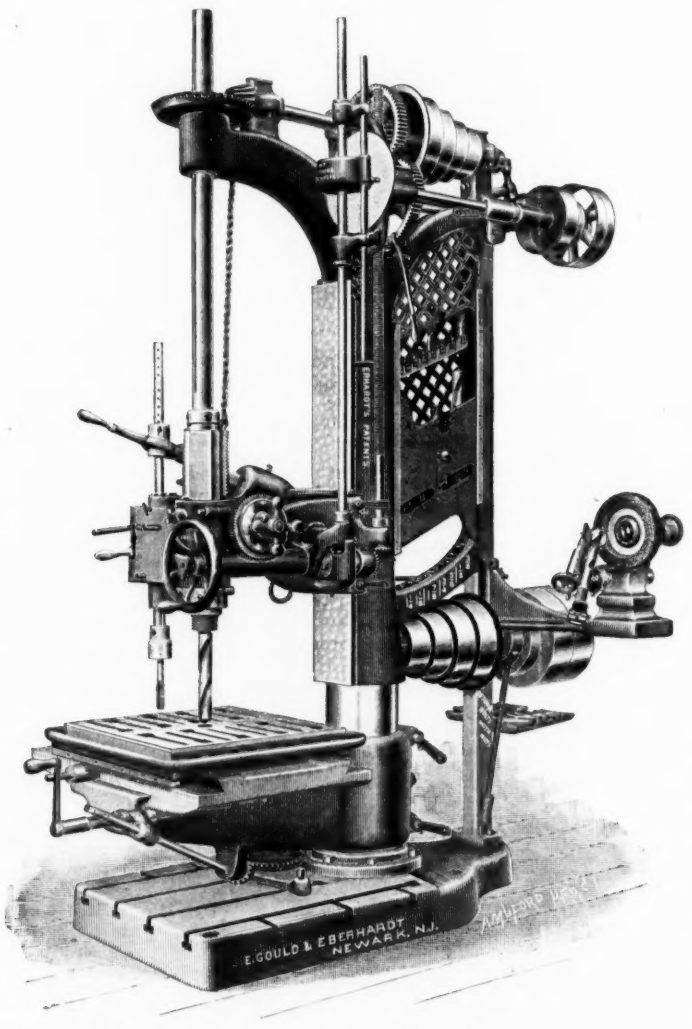


Fig. 2.

IMPROVED DRILL PRESSES.

Convenience in the Machine Shop.

BY A MECHANIC.

Perhaps in speaking of convenience it would be well to say something about inconveniences.

An acquaintance of mine, who is an old-time machinist, was telling me of his first experience after leaving the shop of his apprentice days. The shop where he had just left was one of those old-fashioned job shops, where they would mend or make anything that was hauled to the door or chalked out on the shop floor, and they would not stand at making a piano, or a milking stool, if any one would give them a job. He had learned to do a great many kinds of jobs under adverse circumstances, and more than that, he had found out that it was possible, and sometimes not a bit hard, to devise a scheme and do a job that his old boss never heard of or thought of; and so he did not feel very faint-hearted when going into a new shop.

The new shop, although new to him, was quite an old shop, too. About the only difference he noticed was that it was larger than the one he had left, though it was conducted about the same. He made up his mind on this score at his first glimpse. The foreman had his corner fenced off, and also there was a good, substantial breakwater around his fence, made of jobs to be done, jobs done, and castings and other material to do jobs with. When a workman got out of a job he would come up to the foreman's fence, and there get another one, and then all he had to do was to fall back into the depths of the shop and do it. Any tool was free to any workman who got there first.

We will go, in our minds, with this new man for a little while, and see how convenient everything was there. Among the castings near the foreman's fence were two large pulleys. I think he told me they were 8 feet in diameter, and perhaps 10" face. This is his first job. His orders were to bore the hub and cut a key-way. The sizes were given him on a slip of paper.

The foreman had no time to go with the man and find some kind of a rig to do it with. This was the man's business. Perhaps this job was given him for a kind of test, to see what he was made of. The first thing, he goes on a cruise to see if he can discover any conveniences for the job. The only thing he sees that will apply at all is an old suspension drill, the range of which is only limited by the brick wall about 25 feet away. He finds a laborer to help him, and rolls the pulleys down there.

He has got the job to do, and the machine tool to do it with, and the shop to do it in (and right here a great many men when fitting up a machine shop are disposed to stop), but there are other things he needs. He wants a bed-plate to bolt to the floor, with a hole to make a bearing for the lower end of the boring bar. He wants the boring bar and cutters too. He wants bolts and straps to fasten the wheel to the floor. If he was only back in the old shop, he would go to his own private hiding place, and find some of these things, probably, but he hasn't established his hiding place here yet; he will later on.

He inquires of some of the other workmen, and is told that "Bill" bored some wheels as large as these there three or four years ago, but "Bill" has been gone from here a year.

He goes hunting again, and succeeds in finding probably the same bar that "Bill" used. He finds a piece of scrap that will answer for a bed-plate, and a lot of old odds and ends of bolts and straps. He gets the blacksmith to help him fix up the bolts and straps, and makes cutters for the boring bar, for probably the cutters "Bill" used had gone into scrap long ago.

After a while he gets the wheels bored, and then he throws the bar back where he got it, and the bed-plate where he got it (in the scrap pile), but the bolts and straps and cutters are his. He finds a hiding place, and hides his treasures. Some men have a large drawer or closet with a big padlock on it, but a man who has not got a lock has to resort to the old-fashioned plan of hiding.

He then slings the wheels with the crane and chips the key-ways, and then his job is finished. The turning off in this case is only a scouring off with a piece of grindstone after the wheels are mounted in their places in the mill. About six months after this another new man came into the shop, and, as luck would have it, they had another big pulley for him. He goes around the shop, and his spirits run down to the

lowest notch. Finally he asks some one how they bore such wheels there, and is told that my friend bored the last ones; perhaps he can show him.

My friend showed him where the boring bar was, and told him that probably the bed-plate that he used had gone through the foundry long ago. By helps from all around he finally got the job done, but he found the work there too much for him, so did not stay long.

Probably this last man went to some other shop, and told that there was no convenience at all in the shop he had just left. Now there were conveniences there, but this last man did not understand.

Any man going into such a shop, who is not "on to the racket," will think that they have nothing there to do work with, but let him pick the big lock on some of these private cupboards, and he will find a pretty well equipped tool-room. It costs a great deal more to well equip a tool-room for every man than it does one for all, especially so when all tools are made one at a time by the most inconvenient means.

Of course there are shops where every man does not have a tool-room, and where the whole shop does not, and where no one is allowed to make and keep any kind of a convenience, and where the foreman of the shop will not have anything to do with any new-fangled notions in the way of getting work out cheaper. Such a shop (if it continues to do business) does work by the hour, and anything to be a convenience there must be something to use up more time. I will not use space to describe such conveniences, for I believe they are pretty well known.

In speaking of real conveniences, the modern tool-room comes in for first notice. If I could build a machine shop to just suit my idea, I would have a very large tool-room. I would commence building it before commencing the shop, and besides the usual arrangement, I would equip this tool-room with a great many of the best machine tools. I would hire the best men I could get to work in this tool-room, and I would try to do the regular line of work in there. I would not bother with the machine shop till I found the first scheme unsuccessful. This would be for a shop where special machines are intended to be built as cheaply as is possible. In a shop where there are the great number of changes that are necessary when building a new machine, it is the greatest convenience to have all tools where the workmen can get them with the least trouble, and where he can see just what the shop has got, and all there is, and so has a chance to pick out what is most suitable. I have been bothered a great deal this way, and have come to the conclusion that on some kinds of work a modern tool-room is a nuisance. I remember while working in a certain shop one day I had an extra number of little jobs, and at night while at the tool-room window the man there asked me if I knew how many times I had been there that day. I replied that I did not, but that it appeared to me that I had been there most of the day. "You was here 27 times this forenoon," was the reply. I thought to get over this difficulty I would get a job in the tool-room. I got such a job, and find that my idea is correct. With the same machine tools a man can do on some jobs twice as much work in the tool-room. I don't have any trouble in putting tools back in their places, and I believe with the right kind of workmen and the right kind of management that there would be no trouble; it is the same case as the grindstone. Because the grindstone is not properly managed some got the idea that it is no good. I have worked in shops where they had no tool-room, and where you could not find tools when they were wanted, but there was no place provided to keep tools in; there was no system, no management there. Every man did as he had a mind to, and the manager thought he knew it all, and so could not learn any more.

It would not be my suggestion to dispense with the tool-room, but to dispense with the machine shop. A friend of mine says I am too radical; that if I say these things no one will take any stock in anything I might say, so I will come down a little, and later on see if we can't find a place for both machine shop and tool-room.

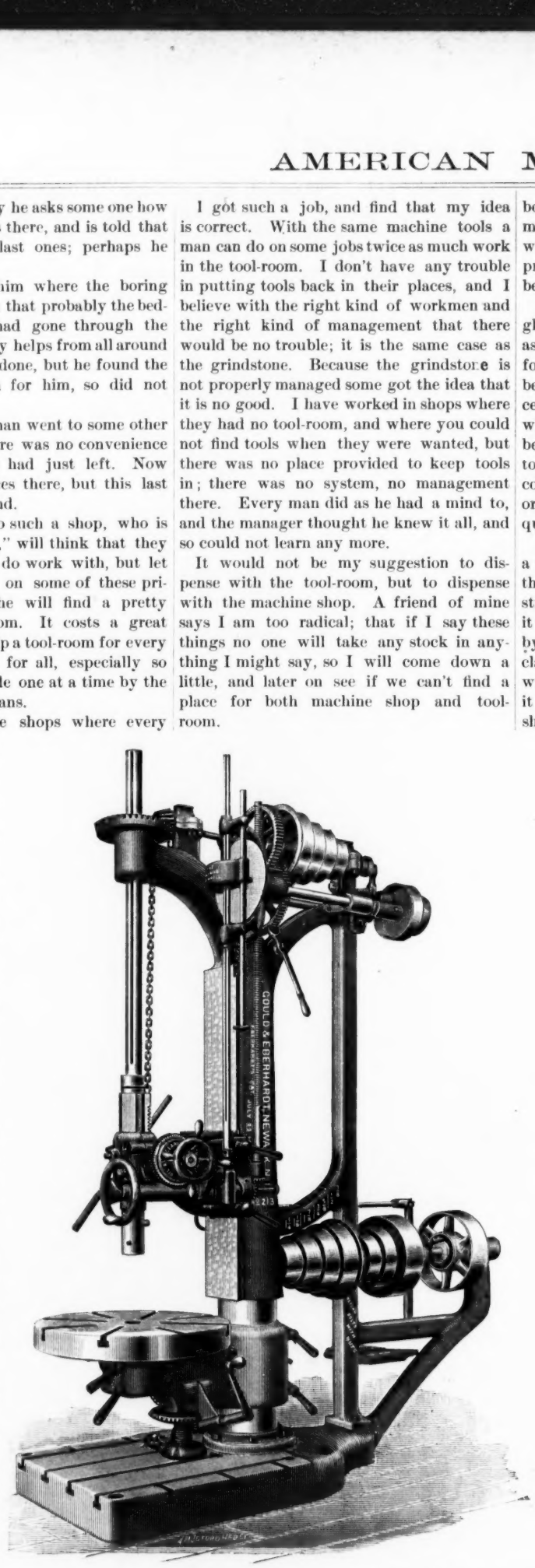


Fig. 3.

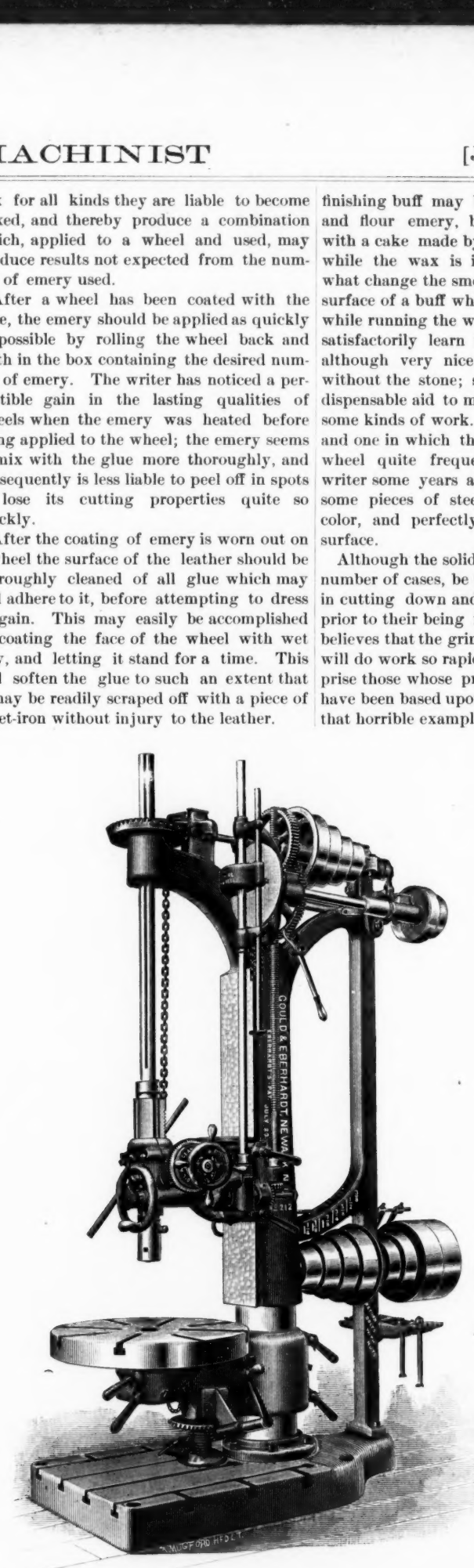


Fig. 4.

IMPROVED DRILL PRESSES.—SEE PAGE 1.

Polishing Wheels.

BY F. H. TREACY.

THIRD PAPER.

It will be well to bear in mind that, no matter how much work and care have been expended in constructing polishing wheels in the first instance, their life will be materially shortened unless they receive proper care while in the hands of the workman. One of the most destructive operations connected with polishing wheels is the way in which they are often filled with nails, etc., in order to balance them. In this connection I cannot do better than refer the reader to an article which appeared in the AMERICAN MACHINIST of July 28, 1888, where he will find a neat arrangement which will answer all the requirements, so far as balancing is concerned. The emery should be kept in narrow pine boxes, which also will be found convenient to roll the wheels in after the application of the glue. It is best to provide a separate box for each number of emery in common use, for by using one box for all kinds they are liable to become mixed, and thereby produce a combination which, applied to a wheel and used, may produce results not expected from the number of emery used.

After a wheel has been coated with the glue, the emery should be applied as quickly as possible by rolling the wheel back and forth in the box containing the desired number of emery. The writer has noticed a perceptible gain in the lasting qualities of wheels when the emery was heated before being applied to the wheel; the emery seems to mix with the glue more thoroughly, and consequently is less liable to peel off in spots or lose its cutting properties quite so quickly.

After the coating of emery is worn out on a wheel the surface of the leather should be thoroughly cleaned of all glue which may still adhere to it, before attempting to dress it again. This may easily be accomplished by coating the face of the wheel with wet clay, and letting it stand for a time. This will soften the glue to such an extent that it may be readily scraped off with a piece of sheet-iron without injury to the leather.

In order to obtain the best results the wheel should at all times be kept as true as possible on the face, for it will be found quite a difficult feat to preserve square corners on the work when using a bad wheel, while the sensations experienced by the user in his hands and arms will not be of the most comfortable kind. In an art like polishing, where so much depends upon the skill of the operator, the novice cannot afford to neglect giving close attention to every detail of the commonly known things connected with polishing, and necessary to good results in order that success or failure may rest entirely upon himself, and not in part with the appliances used.

While it is possible with fine emery on a wheel to polish a rough casting or forging, it will not be found either a cheap or satisfactory way. It is better to remove all the scale and roughness first on a coarse solid wheel or grindstone, then go to a wheel dressed with sixty or eighty emery to remove the deep scratches and roughness left by the stone or solid wheel, and finally finish on a buff dressed with No. 100 or finer, according to the degree of finish desired. A finishing buff may be coated with beeswax and flour emery, by rubbing the surface with a cake made by stirring in the emery while the wax is in a melted state. Just what change the smooth stone makes in the surface of a buff wheel when held against it while running the writer is unable to say, or satisfactorily learn from those who use it, although very nice work can be produced without the stone; still it seems to be an indispensable aid to many expert polishers on some kinds of work. One effect in polishing, and one in which the stone was used on the wheel quite frequently, as seen by the writer some years ago, was the coloring of some pieces of steel to a beautiful straw color, and perfectly even over the whole surface.

Although the solid emery wheel can, in a number of cases, be used to good advantage in cutting down and shaping rough pieces prior to their being finished, still the writer believes that the grindstone properly handled will do work so rapidly as to somewhat surprise those whose prejudiced opinions of it have been based upon an acquaintance with that horrible example—the average machine shop grindstone. Having committed myself to this extent, after all that has been written in favor of the solid wheel, it may be well to describe a grindstone outfit which the writer considers able to cope with the solid wheel. A description also of the emery belt and its use in connection with the frame, described in the first article, together with some things not mentioned about the grindstone by former writers on the subject, will be taken up in another paper.

Sketches of an Apprenticeship.

BY W. S. ROGERS.

There was a shop in one end of our town that we cubs took a sort of interest in, and when our half day off came round we seldom missed calling there. You see, it was run or managed by a chap who received his mechanical education in a grocery store, then got somewhat of a reputation as clerk or salesman down at the soap works, at about which time his uncle or some other relative advanced him several thousand dollars to go in business for himself. His first effort was a lingering death in the hardware business; he next started this machine shop I am trying to tell about. He often came to the Old Man and wanted to consolidate, but as our boss had no use for a man unless he carried a pretty fair tonnage of sand and nerve, it was no go.

Well, they made all sorts of things down in that shop, from sewing machine bobbins to pretzel and brick machines, and everything was made to standard sizes. He used to lay special stress on the "standard" in advertising, while the only standard we found in use during our visits was the ten-cent two-foot rule carried by the foreman, and it wasn't new by a few years. Two of our jours who had worked there said there was not a true mandrel in the shop. The foreman of the place got eighteen dollars a week for climbing up and down three flights of stairs dogging the men on to their work, while our Tom got thirty dollars, and had a couple of assistants to do the climbing

round. The foreman down there was a driver; so was our Tom, but there was a big difference in their ways of driving. If a man didn't do the amount of work they thought he should, he received a "cussing." In fact, you could find dams (not made of water) flowing round that place in every corner. With us, Tom never "cussed" the men or lost his temper (neither was it safe for a jour. to swear at us cubs in Tom's presence), but it always seemed to be a race between the men to excel on one side, and Tom to extend the limit of production on the other and preserve good workmanship.

I remember when several of us would be moving a heavy casting, and it was about all we could manage, Tom would come along, and, getting a hold, would sing out: "Now, boys, all together, and watch her go!" and easy it would go; but I noticed that Tom didn't lift a pound—he just "enthused."

But I've got away from my story. The chap down at the other shop had tried to do something original, and bring out improvements so many times, and had failed so signally, that when the Old Man one day proposed to sell him all the patterns, drawings and good will of his 6"x10" agricultural engines, he didn't hesitate long (as we cubs expressed it) "to bite on"; and after the deal was made it was interesting to go down and watch those engines go together, and if the proprietor's opinion was worth anything it must have been interesting trying to dispose of them afterward. The Old Man seldom let go of anything until competition had about forced the margin of profit down to zero. Then our proprietor took especial pride in calling things his own. He could abide borrowed capital, but not borrowed brains.

A New Tapping Attachment.

We present herewith illustrations of a new tapping attachment for drill presses, in the construction of which the object has been to provide something simple in construction, strong enough for the work, and so made as to be easily applied to any drill press without the necessity for making changes in the machine.

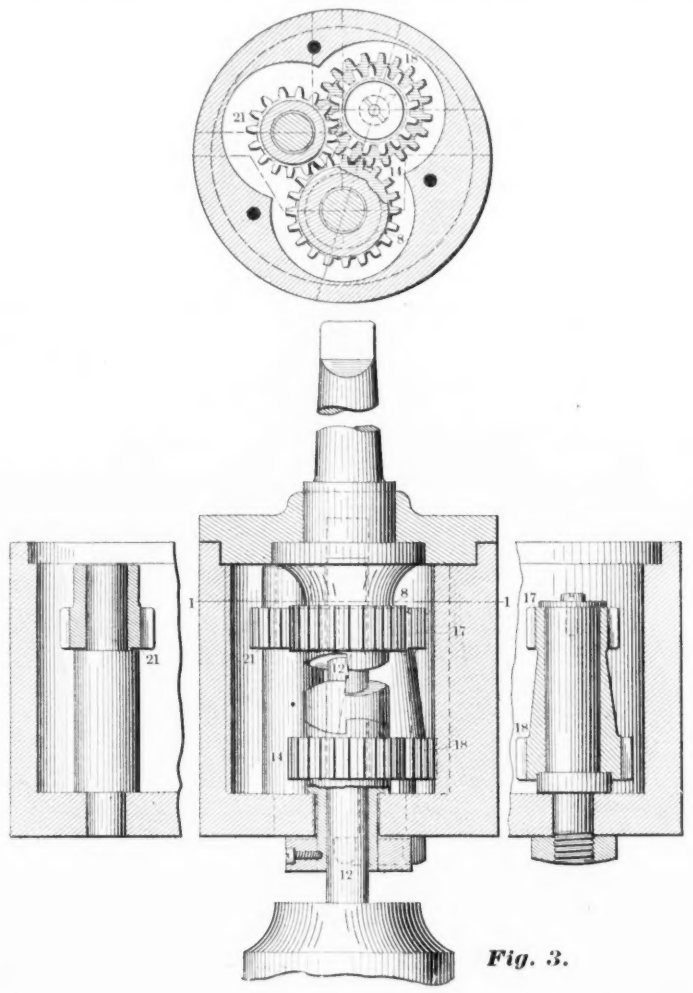
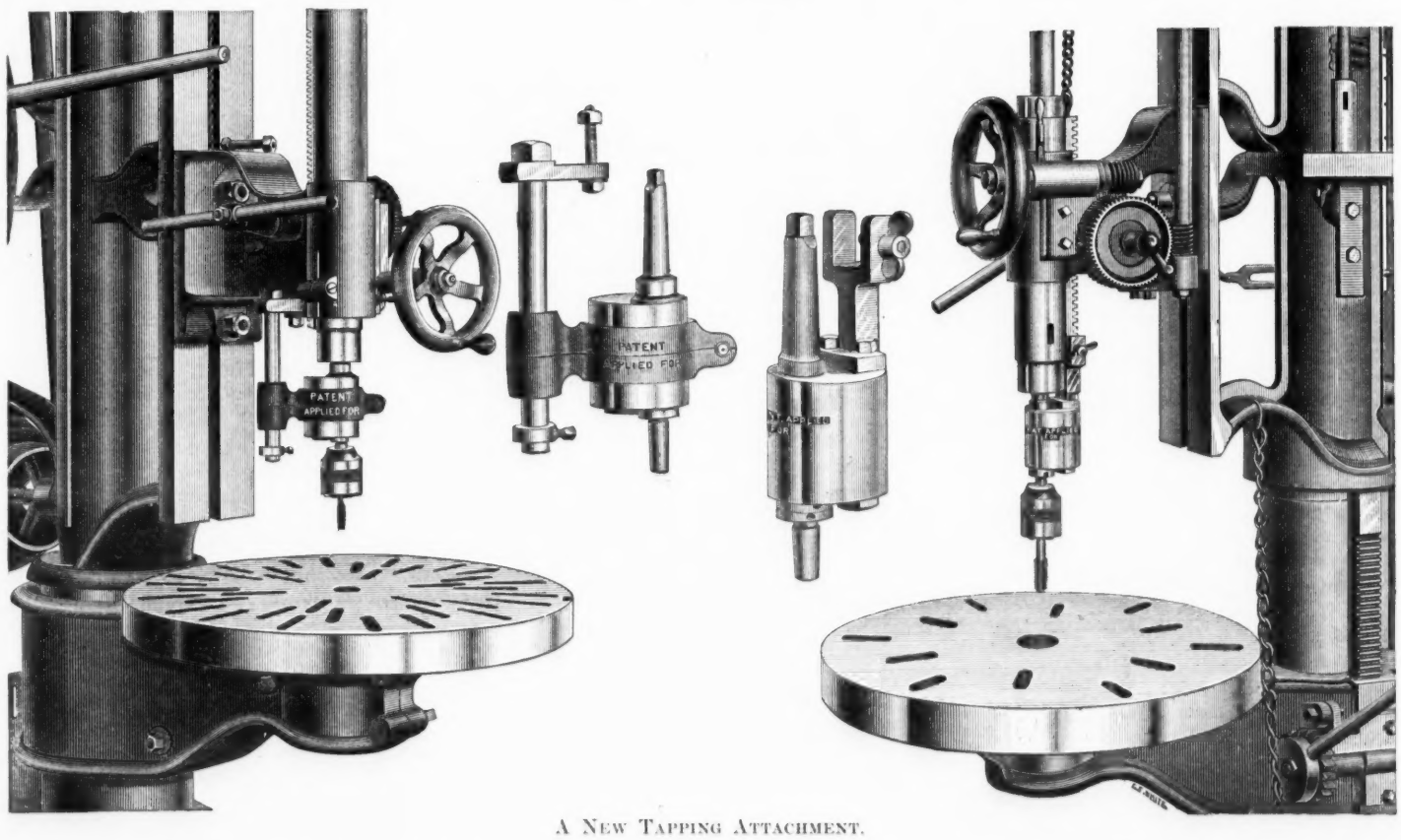


Fig. 3.



A NEW TAPPING ATTACHMENT.

The attachment consists essentially of a cylindrical case, through which passes a spindle, the upper end of which is tapered to fit the drill spindle. Inside the case this spindle is bored out to receive another spindle (12, Fig. 3,) which is free to move up or down within the first-named spindle, and is driven by means of the double-ended clutch shown. To the lower end of the spindle (12) the chuck or socket for holding the tap is attached in the usual manner. At the lower end of the primary spindle (which is shaped to form one of the clutch faces) is a gear (8) which engages with and drives pinion (21), which is an idler running upon a fixed stud, and this in turn drives gear 17, which is upon a loose sleeve running upon another fixed stud, this sleeve having at its lower extremity gear 18, which drives gear 14 and its clutch in the opposite direction to that of 8, and, owing to the proportions of the gears, at a somewhat higher speed. The detail cut does not show the lower clutch right, as it should be arranged to drive spindle (12) in the opposite direction, so as to back the tap out when thrown in by the upward movement of the drill press spindle, the cut showing it, however, as though both clutches drove in the same direction, which is not the case. The case and enclosed mechanism is prevented from revolving with the spindle by either of the two methods shown in the perspective views.

In use, supposing a hole is to be tapped, the weight of the chuck, etc., draws the spindle 12 downwards, and it is then driven backwards through the medium of the gears and lower clutch; but upon the tap coming into contact with the work it can descend no further, and by the continued downward motion of the spindle the lower clutch is disengaged and the upper one thrown in, spindle 12 being then driven in the direction for tapping. When the hole is tapped to the proper depth, raising the spindle throws in the lower clutch again, and the tap is rapidly backed out.

It will be noticed that, though the gears are running all the time, they have no work to do except in backing out the tap, the tapping being done by direct driving of the upper clutch. The device is, of course, applicable to any drill press or to a lathe, and has been found by trial in the shops of the manufacturers, where it has been thoroughly tested by use, to effect a remarkable saving in cost of tapping and in taps over hand work, besides doing better work. All working parts are made of steel. It is manufactured by the Granger Foundry & Machine Co., Providence, R. I.

Raced with the Engine.

So many remarkable stories are told illustrating presence of mind, that a story may be welcome which tells of the opposite quality—not mere forgetfulness or heedlessness, which is dignified with the name of absent-mindedness, but the faculty of being left, in some emergency, apparently without any mind at all.

At a recent international fair or industrial exhibition in Buffalo there was shown a new sort of engine which went around and around on a circular track level with the ground.

As the crowd stood humming in the track, gazing at the queer locomotive, a very stout woman, who was eating peanuts from a paper bag, became frightened by a rearing horse near by, and stepped upon the track directly in front of the moving engine. The engineer blew his whistle, and this scared the woman so badly that her discretion was really frightened away.

With a scream she ran frantically along the track in front of the approaching engine, still clinging to the bag of peanuts and swinging it in the air so violently that it sprung a leak, scattering the peanuts in a thin trail behind her. She was stout, and the effort to run made her a singular spectacle, but she was in terror of her life and traveled around the track at a goodly pace.

The crowd became wildly excited.

"Hooray! hooray!" men shouted. "Go it! you'll git thar first!"

"Stop your engine! you'll run over her!" shouted an elderly gentleman, waving his umbrella at the engineer as the machine went past him.

"No danger—I can't catch her at the rate she's going!" the engineer shouted back.

Women screamed, boys cheered and dogs barked, and all the time the engineer kept blowing his whistle. Meanwhile the stout woman had made three wild trips entirely around the track. Then, in her desperation, her absent mind came back, and it occurred to her to step off the track. She did so, and the engine went past.

As she came off, red in the face and out of breath, she still grasped her paper bag firmly. But the peanuts were all gone.—*Youth's Companion.*

A Matter of Interest to Manufacturers.

It having been brought to our notice that the Morse Twist Drill Company was dissatisfied with some of the provisions of the new tariff law, through which a rather remarkable increase of duties was exacted of them, we wrote the president of the company, Mr. Edward S. Taber, and have received the reply which we publish below:

"We have yours of the 7th, referring to a matter which has caused us disappointment and concern, and perhaps a measure of disgust at party management of tariff matters.

This is illustrated in some provisions of the recent tariff law; as an instance, the import duty required on bright round steel rods and wire; and to this I would like to refer. The Morse Twist Drill and Machine Company has, since its organization in 1864, imported Stubs' bright steel rods and wire, and used the same in making drills, taps and small tools. The duties assessed on invoices previous to the McKinley bill and present law, have been considered reasonable and satisfactory to importers, and have well protected makers of bright steel wire in this country,

and must have been satisfactory to them, as evidenced by their present price for steel wire, which has not been increased since the new tariff law took effect. Under the new law certain sizes of wire, say, sizes No. 10 to No. 16, will cost the importer 52 to 54 cents per pound. Heretofore these sizes cost to import 39 cents per pound. The same sizes of American make are offered at 35 cents per pound, and less, and have not been affected by the recent tariff legislation, or advanced, although protected to 52 or 54 cents per pound. This to the credit of the makers in this country of fine quality steel wire. They are content with the margin of profit under old prices for their product. They show themselves reasonable in their requirement, and show that they understand the general subject, way beyond the framers and promoters of the McKinley bill, as it applies to their interests. We have not until the past week known the full sum to be required of us from the custom department for duties on a recent invoice. The invoice was in the net sum of £1,745 6s. 1d. Nov. 18th last we paid $865.41 for duties as they were at the time estimated, and the imported cases, 32 in number, were delivered to our company. Since then the examiners and appraisers have revised their figures, and we have been notified of an additional sum due on the goods imported, and Jan. 6th we paid the sum so declared due, viz., $2,098.19. The total of duties so paid is $2,963.60. Under the old law the duty would have been $478.27. This is the full sum which would have been required of us on the invoice we have referred to. The increase of duty is six hundred and twenty per cent.

"We enclose a sheet, showing the manner in which the duty was estimated under the new tariff, and as it would have been assessed under the old tariff. The writer has carefully revised the estimates as under the old law, and feels sure that they are correct and dependable. We shall be pleased to furnish any further points or information as you may desire it.

"STATEMENT OF DUTIES ASSESSED AND PAID UNDER THE TARIFF LAW OF 1890, ON AN INVOICE OF BRIGHT ROUND STEEL RODS AND WIRE, IMPORTED INTO BOSTON, MASS., NOV., 1890. AMOUNT OF INVOICE £1,745 6s. 1d.

9,551 lbs.	bars at 7¼c....	$ 692.45
12,157 "	wire, value $5,047 at 45%.....	2,271.15
		$2,963.60

"STATEMENT OF DUTIES AS THEY WOULD HAVE BEEN ESTIMATED ON THE ABOVE INVOICE UNDER THE TARIFF LAW OF 1883.

6,489 lbs.	bars at 3½c... ..	$227.11
11,071 "	wire at 1½c.....	166.06
3,716 "	" " 2c.	74.32
431 "	" " 2½c.. ...	10.78
		$478.27

Increase of duty, 620 per cent.

"We may add that the duties to be assessed on steel rods and wire under the new bill will be found under sections of the Metal Schedule, viz., No. 140—Steel valued above 16 cents per pound, the duty 7 cents per pound. No. 142—Steel valued above 4 cents per pound, the duty 45 per cent. *ad valorem*. No. 146—Steel polished, ¼ cent per pound additional.

"These rates cannot be considered protective. American makers do not require them. They are prohibitive, are aggressive, and a hindrance and a wrong extended to manufacturers using fine steel wire, makers of small tools, piano makers, etc.

Yours Respectfully,
EDWARD S. TABER."

Improved Screw Machine Turret Lathe.

The screw machine and turret lathe herewith illustrated are manufactured by the Garvin Machine Company, New York.

They comprise their latest designs in this class of lathes, of which they manufacture a very complete line.

The screw machine is known as their No. 3 size, and is 14" swing, 4½ feet bed. It is arranged with power feed and automatic stop, the feed rod and connections are placed on the front of the lathe for convenience in handling. The feed is tripped by means of an adjustable dog, carried on top of the turret slide.

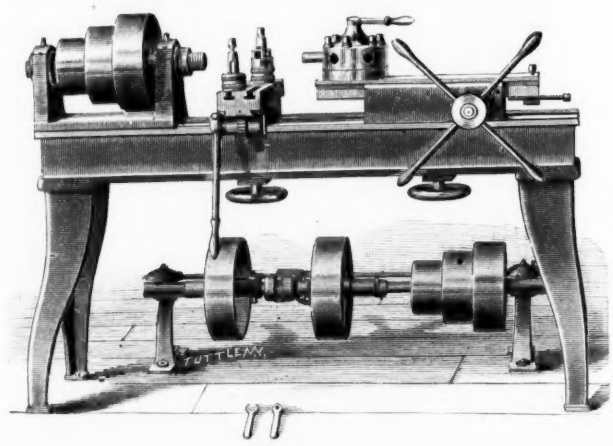
The spindle runs in composition boxes, and has a 1½ inch hole its entire length; the outer end of spindle is threaded for chucks, or is made with automatic spring chucks and wire feed.

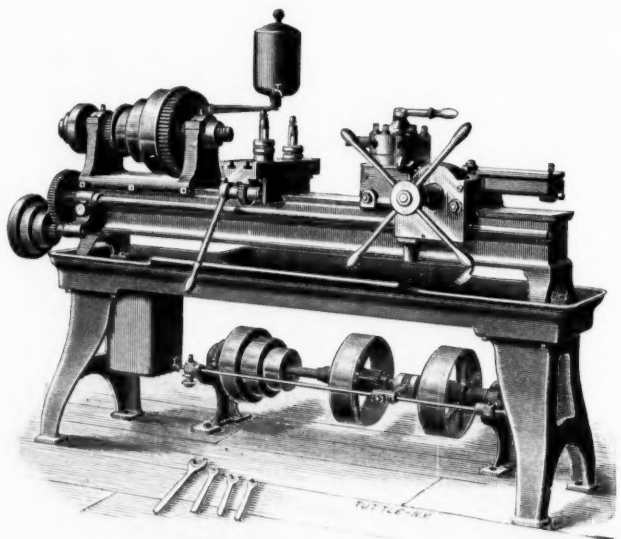
The spring chucks used are of new pattern, which have no end motion when gripping stock.

The turret is 8 inches diameter, with eight 1½ inch holes for tools, and has a movement of 12 inches. The cross slide is made with rack or screw feed, and with stop for each tool.

The head is made as shown, with back gears, or with plain cone, or back gears and friction clutch. The friction clutch head admits of changing instantly from fast to slow speeds, or stopping, as desired. This is particularly valuable when using large dies, or when different parts of the work vary largely in diameter.

This machine is also made with extra large





IMPROVED SCREW MACHINE TURRET LATHE.

spindle, when desired, which gives a 2½ inch hole in spindle, or 1½ inch hole with wire feed and spring chuck. The pan for chips is especially large, and has side extension where chips accumulate, with oil pot at end, where it is not liable to become clogged. Countershaft has self-oiling boxes, with friction pulleys 14 inches diameter, 4 inches face.

Weight of machine, complete, 1600 lbs.

The turret lathe here shown is designed for all classes of work where oil is not required. It is made with the same heads, spindles and turret as the No. 3 screw machine, and with plain chuck, spring chuck or wire feed.

It is also made with draw-in chuck, operated by hand-wheel at back of spindle. It is 16 inches swing, and the bed is of open pattern with V's.

The cross slide and turret block are clamped with hand-wheel shown. Countershaft has friction pulleys 14 inches diameter, 4 inches face.

Weight of machine, complete, 1,400 lbs.

The Russian government is building an enormous ironclad of 12,480 tons.

Shop Notes.

Waltham, Mass., is remarkable, in a mechanical way, for three things. Cotton cloth was first made there complete from the raw material under one roof; watches were first manufactured there complete in one establishment; and in the same town it was first possible for a man or company, who proposed to go into the business of manufacturing watches, to contract for the complete plant of machinery and tools for doing it, the same as it had been before possible to do in other towns, in the case of sewing machines, arms, etc.

On the bank of the Charles River, near the railroad station, is to be seen a brick building (still used as a factory for the manufacture of special lines of cotton goods), a small portion of the brick walls of which can readily be distinguished from the balance, which has been added from time to time, the original portions having composed the walls of the factory, in which raw cotton was first manufactured into the completed cloth. The entire building is not large as cotton factories go nowadays, but the older and redder portions of the walls constitute only a small fraction of the present building. And yet, when cotton cloth was first made here, the event was celebrated as of considerable importance, and President Thomas Jefferson, who was present, is said to have remarked that it was a wonder where the demand could be found for such vast quantities of cotton cloth as could then be made there. Jefferson gave evidence of being able to see at least as far ahead into the development of this country as any man of his time, especially in matters pertaining to mechanics and manufacturing, and the incident, when recalled in connection with the present magnitude of the cotton industry, shows how little of the future (our present) was foreseen by even the shrewdest men of that day. The Boston Manufacturing Company runs the place now, and a visitor who calls at the office may be shown, among other interesting things, an old account book dating back to 1813, and containing some entries which recall the customs of the time. Among the entries for cash expended, occur items for "Rum and Molasses," "Postage of Letter from Laughton, 15 cents," "N. R. Whitney, bill Rum $34.10." In these degenerate days, workmen buy their own rum, and, according to some of our wise reformers, spend rather more than their entire income for it.

THE WATCH FACTORY.

Nothing like a complete account of what is to be seen at the factory of the American Waltham Watch Company can be attempted here. In many of the operations to be seen, it is easy to trace the influence of the armories and sewing machine shops, many of the special machines used being plainly derived from that source, modified, of course, to meet the different requirements. The profiling machine, for instance, is recognized in the machine which forms the irregular edge of the plate which partially covers the movement of some watches, and there are many special adaptations of the lathe fitted with a special chuck for the piece worked upon, and tools for performing a certain single operation upon it in the quickest and best possible manner. All the machines are small, of course, and the best workmanship is put upon them.

A curious adaptation of the jig principle is seen in a small drill press for drilling a certain plate, in which there is a number of holes of one size. Of course this press is a very small affair, which stands on a bench and runs its spindle at a speed comparable with that of wood-working machinery. Fixed in the table of the machine, below the drill and in line with it, is a stud which is tapering, the smallest end being upwards. The plate to be drilled is placed on top of the jig or template, which is simply a plate having bushings in the lower side, which fit over the stud spoken of, and are located to correspond to the position of the holes to be drilled. The piece to be drilled is held in place on the jig by the fingers of the workman, who simply lifts the jig, and places one bushing after the other over the stud, and drills a hole over (instead of through) each bushing, there being nothing to guide the drill or keep it from "running off," should it tend to do so, though, of course, this is provided for within the limits required for that particular operation by the high speed, and uniformly soft metal drilled.

AUTOMATIC SCREW MACHINES.

Among the most interesting machines are those on which the screws are made. There are long rows of these standing upon benches; they are automatic, one man attending to a great many of them, and having little to do except to put in a new polished steel wire occasionally for stock. Of course this is when all goes well, however, for there are times when there is trouble with the dies or with some one of a hundred things, these machines resembling the larger ones, with which many machinists are familiar, in this respect.

The most interesting of these is, of course, the one which makes the smallest screws. These screws are plain, threaded close up to the head, which is of the filister variety and slotted for a screw-driver. The threads are very clean, smooth and well formed, and the entire screw is what would be pronounced a good job. These facts regarding them are not determined, however, by a mere glance of the eye, as would be done in the case of the ordinary screw; for, in fact, they cannot by most persons be recognized as screws, nor do they seem to have any definite form until examined through a magnifying glass. The threaded portion of them is .056 of a centimeter, or about .0143 inch diameter, and there are 240 threads per inch. The total length of the screw is about .035", and the diameter of the head .026". When laid upon an ordinary steel rule, graduated in hundredths of inch, such as used by machinists, and then examined with a good glass, it is seen that the shoulder under the head is not square, but at an angle, the total thickness of the head being .01", and the slot about half that depth, its width being less than that of the lines upon the scale. When a number of them are placed under a glass together, it is seen that the thickness of the heads is not precisely uniform, and when the total length is measured by a micrometer caliper it is found that this varies with the variation of the heads, as does also the depth of the slots. In the case of the ordinary automatic screw machine we should

say that a machine which made the heads of some screws half as thick as others was not doing very well, but with these screws, where such a variation occurs, measurement by micrometer shows the variation to be only .005″. It does seem to indicate, however, that the plan adopted for a feed does not produce as good results as are obtained by the larger machines which feed the stock against a stop.

The machine which makes these screws has no turret, the threads being cut by a single die which is held in a chuck at the end of a spindle corresponding to the foot-stock spindle of the lathe. It is set in motion and reversed for running the die on and off, and advanced and drawn back at the proper time by means of cams and levers. A curious thing about it is the fact that the die, after it has been run on, is used to draw the wire through the chuck the proper distance for the next screw; it is then run off and the back tool comes up, cuts off the screw just completed, and reduces the stock for the next one; the front tool then finishes it ready for threading. When the screws are cut off they are received within a split chuck, which is fixed in the end of a lever. This lever is then swung over towards the back, and holds the head of the screw in proper position, so that a small saw revolving upon an arbor, and moved up and down by a cam, cuts the slot, after which the screw is released and falls into a suitable receptacle. While the slotting is being done another screw is being made, and the little lever arm, with its gripping chuck which carries the screws from one operation to the other, works incessantly, and drops out the finished screws at the rate of about 5,000 per day. The largest screw made on such a machine is the one which holds the movement in its place in the case, and can be seen in most watches by opening the back cover. This screw has one side of the head slotted off, and this is done by placing a saw on the arbor beside the one which cuts the slot, it being enough larger in diameter so that it cuts through the head when the slotting saw cuts the proper depth. These machines have a single hollow spindle through which the stock is fed, and held in a split chuck. There are a few other machines here, however, that are of a different type. In these there are a number of spindles which are placed in bearings parallel to each other in a cylinder which revolves at intervals to bring one spindle after the other opposite the fixed spindles which carry the cutting tools. The cylinder with its spindles thus resembles the cylinder of a revolver, each of its spindles being hollow and provided with a split chuck by which the stock is held. When one of these spindles is brought around to a position where an operation is to be performed upon its particular wire, it is driven by a fixed spindle from the back, while another fixed spindle carrying the tools operates from the front. It seems to work well, but there must, of course, be some difficulty in keeping all the spindles in the cylinder at the same distance from the center, and precisely in line with the tool spindle when stopped—a difficulty which, of course, is not encountered in the first-mentioned machine.

THE FACTORY AND ITS EMPLOYES.

The maximum capacity of the factory is 2,500 watches per day, and at the time of our visit 1,900 were being made. There appeared to be plenty of force and machinery for the work; everybody appeared to have enough to do, and worked with the rapidity acquired by long practice at the same operation, stimulated by piece-work, at which good wages are made. The works are exceedingly neat and clean, and in perfect order throughout, and, to judge from appearances, the work and the policy adopted by the management is such as to attract the very best kind of people. Evidence of their taste and the good influence of the factory is to be seen all over the city, which is remarkable for its neatness and "well kept" appearance.

The factory building itself is very attractive in appearance, standing back at a little distance from the street, with a finely laid-out and kept lawn in front, while on the opposite side of the street is Robbins Park, which was established and is maintained by the company, being named after Mr. Robbins, the treasurer and manager of the business. The relations between the company and its employes are said to be of the most pleasant character, any difficulty which may arise being at once settled by a conference in which there is mutual respect, confidence and good will. The employes are about equally divided between the sexes; many of them hold stock in the concern, and it is declared that they not only move in, but really constitute the best society in the city. Many municipal offices of trust and responsibility are occupied by them.

Mr. Robbins justifies the expense of the maintenance of the park, lawns, gardens, etc., by the statement that it pays not only directly in the enhanced value of the company's property generally, but in making the town and the factory attractive to the best people. No one, we think, who goes about among shops much, and who is interested in them and in the people who work in them, can fail to derive much pleasure and encouragement from a visit to this factory.

THE AMERICAN WATCH TOOL CO.

This is the establishment referred to at the beginning as the one in which it was first possible to contract for the building of a complete plant for the production of watches by machinery. Much of the machinery and tools in what have now become famous watch factories was designed and built here, and one factory at least—that in which the Waterbury watches are made—was furnished complete, including the building, ready for operations on a contract with this company. Mr. Ambrose Webster, who is at the head of the enterprise, was formerly superintendent of the Waltham watch factory, until he withdrew to go into the business of making watch tools; and Mr. Whitcomb, who is also well known as a watch and watch tool man, and designer of the Whitcomb lathe, is associated with him.

LATHE BUILDING—GRINDING.

Besides a full line of lathes for watch work, including such as are seen in the windows of the so-called watchmakers all over the country, they make lathes suited to the making of other watch tools, and fitted with screw-cutting attachments, grinding attachments, etc. These lathes are sometimes found in machine shops where the highest grade of light work is done. Owing to their small size, and the great degree of accuracy required, together with the fact that entire interchangeability of all parts is strictly maintained, the method pursued in building them differs quite radically from that in use in the ordinary machine tool shop. The beds, which are cylindrical in shape, except that they are flat on top, are centered and turned in the lathe, the final finish to the cylindrical portions being given by grinding, both because it is found to be the best way to do it and the cheapest as well. The flat upper surface is beveled off at each side at the outer edge, these beveled surfaces answering the same purpose as the shears of the ordinary lathe, both the flat and beveled surfaces being planed, while the bed is supported in V-blocks. The head and foot-stocks are bored on an angle-plate which is attached to the face-plate of a lathe which is used for this and no other purpose, the form of this angle-plate being an exact duplicate of that of the lathe beds, and almost infinite pains having been taken to get it precisely square and in line with the spindle. On this angle-plate the head and foot-stocks are clamped in the same way and by the same device that they are finally clamped upon the finished lathe bed with, and bored out by tools used in a rest in the ordinary way, the weight of the angle-plate and head being carefully counterbalanced. The head-stock casting is alike either way it may be placed on the bed, and both holes are first bored through this the same diameter, the test of accuracy being to reverse it on the angle-plate, and see if the hole which was next the face-plate when bored comes in precisely the same position as the other one when reversed end for end. Hardened and ground bushings are put in for bearings, and the spindles have also hardened and ground bearings. In fact, nothing is more apparent than that the emery wheel used in machines specially designed for the work in most cases is very much depended upon here for the splendid results attained. For grinding the conical surface at the outer end of the live spindle against which the split chucks are drawn, for instance, a special machine is used upon which the otherwise completed head is clamped upon a seat which is an exact duplicate of the lathe bed in shape, and permanently fixed at the proper angle to the traverse of the wheel carrying slide, so that precise uniformity of this angle is absolutely insured, and, the spindle being run in its own bearings, absolute truth is also assured. Another special machine is used solely for grinding the conical surface of the split chucks, so that uniformity and truth are insured in these also, nearly or quite all cylindrical and conical work being finished by grinding with special machines built by the company, and which, though small, in accordance with the character of the work they have to do, are proportionally very heavy and massive. All of this machinery is supplied with all the refinements that can be of any use, and is automatic, so far as it is practicable to make such machinery so. The hole in the split chucks through which the wire passes is ground as the last operation upon the chuck, even to the smallest sizes, a special machine being used for this operation also, pieces of the saws which do the splitting being inserted into the slits and the chuck drawn back into a hardened spindle, the beveled surface of which is known to be as true as possible to be made. In setting the wheel up to its cut in this grinding, the sense of hearing is depended upon mainly, instead of feeling, the sound being conveyed to the ear of the operator by a wire which is inserted in the end of a piece of hard rubber resembling a lead pencil, the wire being placed on the main bearing of the spindle, while the end of the rubber is placed in the ear. Wherever upon a single piece two or more surfaces at an angle to each other are to be ground, and it is important that these surfaces should be precisely true one with the other, the plan is adopted of having a wheel mounted upon a separate slide of the machine for each, thus avoiding the necessity of disturbing the angular adjustment of any slide, and also the necessity of changing the position of the work on the centers.

THE METRIC SYSTEM

is much used in watch work, and every lathe of a certain size, which goes out of this establishment, has drilled in the head-stock some holes intended to receive dowel pins, which are put into an attachment for cutting screws which can be furnished at any time, and drives the screw of the regular rest. In the train of gearing, which goes with it, a pair of translating gears can be placed, which enable metric threads to be cut, these gears, which are both on one stud, having 50 and 127 teeth. As they are practically in the proportion of 1 to .3937, they give an approximation which is close enough for all practical purposes; indeed, so close that the variation from exactitude will hardly be discovered in any screw, as will be seen upon figuring out the proportions to about eight decimal places, and comparing.

FINE PUNCHING.

It is impossible to describe, in an article of this character, all that is to be seen here calculated to awaken the enthusiastic admiration of the tool maker, and it is also unnecessary, as Mr. Webster himself has promised to describe some of them soon, with sketches of the devices used. Among these none are more wonderful than the results obtained by punching sheet-metals with punches and dies used in a special attachment to a press called a sub-press. The complication of shape, and at the same time the extreme accuracy of some of the pieces thus punched, are a revelation even to one who considers that he has seen some pretty good work in this line. Mr. Webster declares that the art of punching has been so far developed that it is possible to punch a piece having two or more holes through it more accurately than it would be possible to drill it in a jig.

A novel method of obtaining drawings of such pieces as these is made use of here, and consists in simply blue printing direct from the pieces themselves the same as from a tracing.

WATCH MANUFACTURING HERE AND ELSEWHERE.

Mr. Webster's attention has not been given solely to the mechanical features of watch manufacturing. He has traveled extensively in England, France and Switzerland, studying not only the mechanical part of the business, but observing also the differences in temperament, habits of thought and action between the men of those countries and of our own. As a result, he declares his belief that it would be found impossible for the workmen of any other country to adopt our American system of manufacturing and make a success of it. Their training and habits for generations have been such as to unfit them for working in our way, and it would take a generation, if not more, for them to adapt themselves to the new system, even supposing a united and determined effort to be made in that direction. And in regard to wages, he says that the talk about Americans getting so much higher wages than in other countries makes him smile, because it is apparent to any one who goes over the ground and takes pains to observe the matter, that, to use his own words, "We get no more than we earn." In 1889, when he was over there, he took considerable pains to inquire into the matter and find out the exact truth, which his familiarity with the business enabled him to do, perhaps better than it could have been done by any one else, and he found that, taking in each case as nearly as possible the same grade of watch, it took at that time two Americans, working one day, to produce it. It took four and a half Englishmen one day to produce it, and five and a half Swiss. At the present time improvements in the machinery and in the skill of the operatives has in the leading American factories got this down to one and a half operatives per day per watch.

Mr. Ambrose Webster relates a story of his early experience, which is not only interesting, but, to him who thinks it over a little, not without its lessons also. After learning his trade in one of the New England armories he found himself, in the early fifties, in the South, and in charge of a department of the mechanical work on the Richmond & Danville Railroad. A center pin in the forward truck of a locomotive had been broken, and Mr. Webster, with a gang of men, jacked the engine up and made the necessary repairs without accident or mishap of any kind. A few days after that, he was called to the august presence of the M. M. and informed that it was thought that he knew hardly enough about the business, and that he had better go home or look for another place. On inquiring what the trouble was he was informed that he had jacked that engine up without putting up any shores at either side to prevent her from tipping over, an omission which might have been attended with the most serious results. Mr. Webster's railroad career ended then and there, and he was soon after in Waltham engaged in watch work, where he has been ever since, and where he has won high honors in the mechanical world. Probably he was much better fitted for such work as is done on watches and watch tools than for locomotive repairs; but it is interesting to note that the man who should put shores up to a locomotive to-day when jacking it up would be looked upon as a curiosity, and probably turned loose to hunt a job in a watch factory or somewhere else.

The cottage owners of Newport do not favor electric cars, and have petitioned the city council to have the tracks removed from the beach route.

LETTERS FROM PRACTICAL MEN.

The Ideal Shop.

Editor American Machinist:

Some months ago, Mr. Booth, in a letter to the AMERICAN MACHINIST, made some suggestions as to the ideal methods of running a shop, and some of them would be pleasant to all concerned. But a little discussion may place them in a clearer light, and bring out the practical points to advantage.

The feature of every man working as long as he saw fit would be pleasant for the man, but would it be a business-like means of procedure?

If you could pick your men, and have them all interested in the work, it might be possible, but as work is done now could it be made a commercial success?

And, even were it possible, is it exactly right for a man who works only part of the time to receive as much for his services as the one who worked the full week? This is the socialistic idea of receiving according to needs rather than according to services performed; this is hardly considered just by the majority, and is hardly to be thought of as practical. Perhaps this was not Mr. Booth's meaning; if not, the only other plan for this kind of working hours seems to be the one that many hold in disfavor—piece-work.

I have no idea that Mr. Booth meant that the first-named plan was the ideal, or intended to pay men for work not performed; his idea, as I understand it, being that the same amount of work be performed, but as the man felt in the mood or disposition for it. In this way performing the same amount of work, but in his own time. With men who were strictly honest in every respect, and who made their employer's interest their own, this might work satisfactorily, though in case of a "hurry order" the men would have to work full time, or else the work would be apt to be behind. But if only men who were strictly honest were employed in any shop, there would be many of those now employed out of work.

It might be the means of reforming some of the men who will take advantage of every one they can, though compulsion is a poor reformer.

But the question of time is an important one in these days, and it would hardly be considered strictly business to run a shop on the go-as-you-please plan, even though the men might do as much work as now, for you could not depend on the time a contract would be filled, as the man on the job might feel indisposed at that particular time. Besides, it hardly seems fair to the men to have the one who has been indisposed receiving the same pay as the rest who have worked full time, and accomplished more work. The only fair remedy seems to be the much-abused system of piece-work, abused by employers into a regular system of "squeeze all you can" out of the men at work, and abused by the men as being the cause of all their ill treatment and poor wages; to some this remedy will seem worse than the evil it is intended to cure—the uneven distribution of wages.

The main objection to the socialistic plan, besides being unjust to the worker, is the tendency to remove the incentive to industry; for, if a man gets the same whether he works or not, the tendency to idleness is increased.

Some refuse to hear piece-work mentioned, and condemn the whole system because they have seen it abused, which, I am sorry to say, is too often the case; but the idea of the system is right, and can be put into practice in an honest manner, the avarice of the employer being the only obstacle in the way of its accomplishment to the satisfaction of all concerned. This does not apply to all employers by any means, and there are many shops where the system is regularly employed, to the credit of the men in charge.

The beauty of this system is that every one receives just what he earns, and no more; there is no dispute as to killing time, and a friendly rivalry between the men is the result. I am well aware that this state of affairs is not often found, and the cut-rate act begins before the system gets fairly started; but this is not the fault of the system, but of the one in charge.

When a rate is fixed for work, it is no excuse for cutting it because the men happen to earn a little more than the regular wages; the proprietor gets the benefit of it in increased production, and should be satisfied with that.

It is the same as breaking a business contract to change the rates on work after they are once fixed, simply because the men earn a little extra; yet this is often done, to the discredit of the man who does it.

While not agreeing with Mr. Booth in many ways, there is one point that I think we will join hands on, and that is the injustice of the ironclad rule as to punctuality at the shop to commence work on time. I used to think that a man who was late was about the worst kind of mortal that was ever invented; but my views on the subject have changed considerably, and I think that circumstances should be taken into consideration. There is no excuse for a man being habitually late in getting to work, and for these I have little sympathy; but where a man has been regular in getting in on time for months, perhaps years, it is not right to dock him if he happens to come in a little late some morning after being delayed by some unavoidable cause. This should especially apply where any one has to depend on the cable cars for transportation.

It will be said that no distinction can be made; but it seems as though the foremen of the different departments might be allowed a little discretion in the matter, and make allowances for the regular and faithful men who deserve to be favored in any matter of this kind. The ideal shop could find an example of liberality and progressiveness in that of Professor Sweet, and the motto might also be copied by his permission: "Visitors always welcome."

In the matter of conveniences for the men, there is a precedent in the shop of the Corliss Safe Works, near Providence, R. I., where everything is provided for their comfort in the way of wash-rooms and closets, water heated for them when desired, and so arranged as to give a constant supply of clean water to all.

There should be no petty bossism in the shop, such as is often seen in cases where some foremen seem to think they own the men, instead of merely having charge of their work in the shop; but every man should have rights that all must respect, and be subject to no petty rules against whistling or any such harmless amusement that does not interfere in any way with a man's work. There should be no rule against sitting down to the work when it was a "sitting-down job," for there are many times when a man can do his work just as well sitting as standing, and in such cases he should be allowed the privilege; work is no better because some one sweats over it when there is no need of it. It is a good plan to let men alone, and not bother them with the ideas of the foreman; unless there is need for instruction, and unless the method of the workman is not as quick or as good as the regular method, he had better be left to himself, for often a better plan may be discovered by watching the new hand, and his methods of working.

Then there are several ways of giving orders, too; the authoritative kind of foreman is never popular, and not respected very highly, while the man who gives his orders in the form of suggestions is the one whom the men try to please, and who has the least trouble with his men. This kind of a foreman has a cheerful word for every one, and does not consider himself above the men in any of the attributes of manhood; he believes in the equality of men as far as personal liberty is concerned, and does not appear to live in another world away from the men around him. Above all things, the shop should be comfortable as far as heat in winter and ventilation in summer is concerned; the rooms should be warm enough to come into, mornings, without danger of catching cold or having a chill over the steam pipes; and means for the escape of the impure air at the top of the room should be provided. When you find cold shops, you can put it down for a fact that the proprietors are men who make a pretense of being charitable, and make a great show of giving a dollar to the mission or some such nonsense, and are preaching charity, when the money they are giving is saved from the expenses of heating the shop, and the men probably all have colds as a reminder of the charity displayed. This may seem cynical, but I have seen so much of it that it always comes to mind when I hear of some shop being too cold for the men to work with safety. The comforts and the health of the men should be the first consideration in designing any building, and in installing any machinery the idea of safety should be the subject of thought and study.

In fact, the whole principle of government and actions toward the men employed should be equality and justice, which may be obtained by a strict observance of moral right.

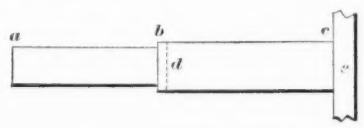
FRED H. COLVIN.

A Boring Bar.

Editor American Machinist:

The article by "Bell Crank," in the AMERICAN MACHINIST of December 25th, 1890, in which he describes the boring of a large pulley to a larger diameter, reminds me of a device I have seen frequently used with the best results.

I once worked in a shop that made a specialty of screw propellers. Quite a number of boats had one in stock already bored out, and in ordering the wheel they very often guessed at the bore. Sometimes the guess would be too small by a sixteenth of an inch. In such a case the machinist would go to the cordwood pile and pick out a stick of wood large enough to turn up to the required size of bore, and over twice the length of the hub of wheel. A part *a b* of the



stick is turned to the size of the original bore *a b*, being about the length of wheel hub. The part *b c* is turned a shade larger than the size of bore required. A hole is then bored through the stick at *d* for a tool of square or round steel, which is driven in, the forward edge of tool coming just at *b*.

The lever *e* is then attached, and the boring bar is ready. The wheel is placed on blocks in a horizontal position, and the bar put in the hole, and the boys furnish the power. By putting weights on the top of lever the required feed is produced, but it usually works well without weights, and always shows a pretty even feed. Of course this would not work, only when the hole could be finished in one cut, unless by turning a new bar.

MAKESHIFT.

Don't Draw Them.

Editor American Machinist:

I was very much interested in your article on "Hardening Steel," in a recent issue, as I have had some experience heating to a "cherry red" with the forge, in a strong light, near a window, and had wondered at the cussedness of the steel that would be all right where you did not care how it was, and would crack wherever a crack would do the most harm. Since I have found out that it was and is possible for "even me" to make mistakes, I have learned more about steel than would have been possible before.

One of the best workmen I know had the misfortune to have me under him for three years, when, being still alive, and not daring to tempt Providence any farther, he retired, after having hammered into me the fact that I knew nothing about steel.

There was nothing would harden the "Old Man's" heart so quickly as to get his eagle eye on a hardened die that had that mottled appearance, and perhaps a crack from every sharp corner, and a few more from inexperience, and several more (if the die was large enough) from heating to a "cherry red," which is an exact heat that to a dozen different men means a dozen different colors. You could draw the Old Man's temper, but you could not soften him any by telling him you knew you did not overheat that die, and there must have been a defect in the steel. But he could make tools that would do more work, and require less grinding, than any tools I have ever seen, and he never "drew the temper on them." They were never overheated when forged, and were hardened at the lowest possible heat. I think he exerted a refining influence on anything he attempted to harden, as I never knew him to spoil anything, not even yours truly; but while he heated steel very low, he frequently roasted me.

I have tried his way of hardening for five years, and get good results. I have a curtain on the window when the sun shines brightly.

I find I have more trouble hardening when it is getting dark, as the light changes so I cannot tell exactly what heat I have got. I have had good work done after dark. The first morning (after working on new steel at night for two weeks), when I thought I had the heat just right, I found my first three pieces exactly alike—that is, they all cracked in the same place. I heated them too high. The others came all right at a lower heat.

I have found it pays to "take the chill off" the water, and does not pay to take the work out of the water until it is cold. My greatest trouble has been heating my work too hot.

WM. HADDOW.

A Large Engine—A Hint on Filing—Countersinking for Screws.

Editor American Machinist:

At the Friedensville zinc mines, six miles south of Allentown, Pa., there is in operation the largest stationary engine in the world. During the past few months it has pumped dry, by underground drainage, nearly every ore pit, spring and small stream within a radius of five miles. The engine is known as the "President," is of 5,000 horsepower, and is run by 16 boilers. At each revolution of its ponderous wheels, a small stream is thrown out, the number of gallons raised every minute being 17,500. The driving wheels are 35 feet in diameter, and weigh 40 tons each. The sweep rod is 40 feet long. The cylinder is 110 inches in diameter, while the piston rod is 18 inches in diameter, and makes a ten-foot stroke.

The engine has a ballast box capable of holding 60 tons, and to feed the boilers 28 tons of coal are required daily. On the engine is the largest nut in the world. It is hexagonal in shape, and weighs 1,600 pounds. To tighten or loosen this nut 20 men are required, while the wrench that fits it is 20 feet long. From the end of the walking-beam of the engine to the bottom of the shaft is 300 feet.

The masonry on which this engine rests is 108 feet deep, some of the foundation stones weighing 5 tons. The engine operates four pumps, three of which are 30 inches in diameter, and the fourth 22 inches in diameter.

Not long ago I turned off the commutator of an electric motor, and then proceeded to file it smooth with a single-cut file, but little particles of copper would stick in the cuts of the file and scratch the copper sections, so, after trying several other fine files with the same results, I finally thought of using the file backwards, which made a good job of it.

In contersinking iron for wood screws, it will be found a good idea to use a drill a trifle larger than the head of the screw, and feed it in until it just cuts its size, after this you need not try the screw in any more holes, as the rest can be gauged by the eye.

X.

Why Good Machinists will Not Serve in the Navy.

Editor American Machinist:

Reading several items in your paper about competent machinists in our engineers' force, I will state some of the reasons, from actual experience, why the better class of machinists will not stay in the service.

First. A good machinist is better paid outside.

Second. He is better treated and more thought of in a private establishment.

Third. He can do as he pleases after his day's work is done; and, fourth, he has some place where he can read, or do otherwise if he feels disposed to do so. All this he has to give up when entering the service. He has not even a place to wash himself when he comes off watch.

Now I don't see why a machinist should not enjoy the same privilege or comforts as a warrant officer, such as a carpenter, sailmaker, boatswain or gunner. I think a machinist is of as much importance as either one of these, and I don't see why he should not enjoy the same comforts as a merchant marine engineer. He is doing the same duty, has to pass about the same examination, and has to put up with a good many things which a merchant marine engineer don't have to put up with.

I read an item in a recent issue of your paper, that it has been suggested to confer the warrant rank on competent machinists familiar with marine work. Should the government decide to do so it would attract a better class of machinists, and our engineers would be greatly benefited by it, because it is absolutely necessary to have a competent class of machinists on board of a man-of-war with its present machinery.

I am corresponding with a number of shipmates now who claim that they will not stay under the present conditions, and will be only too glad when the time arrives to get their discharge. Of course there might be some who are not qualified to hold a warrant officer's po.ition, but this would not be the case if they get and keep the better class of machinists. I hope Congress will take the matter under consideration, and give the parties of the suggestion a favorable answer.

AN HONORABLY DISCHARGED MACHINIST.

"Vacuum Chamber" in Suction Pipe for Pumps.

Editor American Machinist:

In the Dec. 25th issue of the AMERICAN MACHINIST, Mr. W. H. Booth describes a "vacuum chamber" formed by inserting a short flanged pipe of smaller diameter than the main bore tube or suction pipe of a pump in an artesian well, thus forming an annular chamber (*a*) as per Fig. 3.

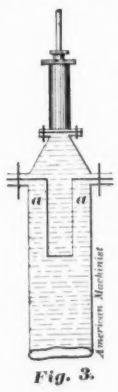


Fig. 3.

Assuming as he does that a vacuum exists in (*a*), no lengthy argument is required, I suppose, to convince him that the water would leave the piston and quietly slip down the pipe and fill that chamber with a bang; since, according to its reputation heretofore, "water will flow down hill," especially if a vacuum be kindly provided for it.

The vacuum will then be at the top, as is usually the case.

No personal reference is here intended, however.

The function of the chamber, therefore, affording as it does a storage reservoir for the moving column of water, is really to make the water spend its acquired energy in more or less compressing the enclosed air, thus bringing about a reaction of the draught of the pump, and creating a pressure rather than a vacuum.

According to the above, it will appear that, if the water is to follow the piston on its upward stroke, there can be no "vacuum" at (*a*), since there must always be enough pressure there to sustain the column of water above it, which pressure, however, is, of course, less than the atmospheric, by as much as would sustain a column of water of a height equal to that from which it is drawn when the piston is on its upward stoke.

When the piston commences its downward stroke, checking the upward movement of the water, resulting in an impact on the air in the chamber, the pressure may rise considerably higher than the atmospheric pressure; therefore, this arrangement is no "vacuum chamber."

I will admit that it affords a practically continuous flow, as claimed, but not in accordance with the "vacuum" theories advanced in the article referred to.

I dispute that its action is to "keep up a draw on the flow of a well during the down stroke, to give out the supply thus stored for the draught stroke of the pump."

An ordinary gas-pipe, capped at the top, and screwed into the suction pipe at its highest available point, and allowed to extend 8 or 10 feet above top of pump, is the simplest and most effective cure for the shock caused by the alternating flow of water in long suction pipes. It also insures a practically continuous and steady supply to the pump.

J. C. GUSTAFSON.

Molding Web Pulleys.

Editor American Machinist:

A few years ago my attention was called to making web pulleys, and, as there was no special rigging for that class of work, we had to do the best we could. The job was quite lengthy and laborious, besides the danger of bad casting, and the continual dissatisfaction to the molder of having his coping torn to pieces in lifting off. This led me to devise a way somewhat easier, and producing better results.

The ordinary way was to ram the rim in the usual manner—this being a draw pulley—and cope out the inner half of pulley. This particular pulley was 36" diameter by 18" face, with a web. What a miserable job it made chucking up bars, securing the cope with gaggers, jamming fingers, nails,

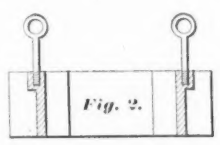


Fig. 2.

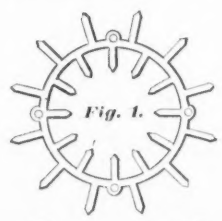


Fig. 1.

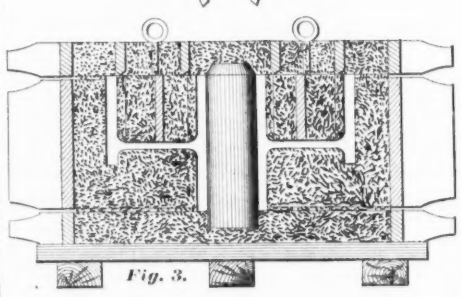


Fig. 3.

and the like, and, when all the time and labor had been put in, when lifting off the cope the most remained on the web plate. Now for patching, nailing, etc., I have seen more than two hours spent in tiresome work by the molder, and when cast the job was rough, and the molder was censured for making poor work. Seeing this a number of times, I set about getting something better, as we did a fair amount of work in that line.

To get my pattern made would cost considerable, and, as the pattern makers were quite busy, I went at it myself. I took a pulley rim of sufficient size, and had a wing made the height and width wanted, and molded the wing to the rim, drawing it to the required height and leaving an opening through the center large enough to allow a six-inch hub or whatever size was wanted. Provision was made for an eye-bolt or screw to lift and hang by. By this method I saved about two hours' time, besides making sure work as far as molding was concerned.

The manner of molding was the same as with previous pulleys, except that the cope was made level with joint, the anchor being rammed up, eye-bolts put in their places, having them come high enough to project a few inches above the cope. In making the joint for coping it was made level with the top of cheek and core of pulley, so that the first lift of pulley was plain; the eye-bolts being drawn, the rim was then taken out, and the cope put back, the eye-bolts returned in their proper place. Then wedge tightly to the margin of flask and bars, with turning rod for support, and hoist with crane.

We had a clean lift, and could finish with some satisfaction. We now make all our pulleys with this style anchor. For small anchor I put on two eye-bolts; large one, four. It is best to take them out after being poured off some time so as not to crack the pulley.

Fig. 1 is a top view of anchor; Fig 2, cross-section of the same. Fig. 3 shows the pulley in flask ready for wedging before lifting off. K.

Hardening Steel.

Editor American Machinist:

I read with interest your article on hardening steel, in the issue of January 8th, as it was somewhat in the line I have been trying. I use "Crescent Special" annealed steel.

I have tried hardening, without drawing temper, about half a dozen reamers, both hand and machine. The hand reamers were taper $\frac{1}{8}$" per foot and cut 10" long and 12" long over all, $\frac{7}{8}$" to $1\frac{1}{16}$" diameter.

They were heated in an open coke fire to a blood-red in the shadow of forge, and dipped slowly into a pail of water heated to a temperature of 112°. They required less than .01" to finish in the grinder, and are doing good service reaming holes from 6" to 10" deep.

These are the only cutting tools I have tried; I have had good success hardening small rolls $\frac{5}{8}$" diameter by 1" long for flue roller expanders, and also sections for sectional expanders. Our process for hardening these is to put a piece of smoke-stack netting over a bright coke fire, and lay the pieces to be hardened on that, and heat slowly to the required heat, when we drop them one by one into a tank of linseed oil.

On the larger sections we find it advantageous to use a little potash, as they don't cut so easy on the pin.

A few trials will show the necessary heat to harden them. Box 13.

Lathe Spindle Screws.

Editor American Machinist:

"A Mechanic," referring to the fitting of a face-plate to a lathe spindle, suggests what he thinks the best way, but there are some objections to it that may yet be noted. With the usual face-plate it is not important that the rim of it be concentric with the spindle, so long as it runs true on the face, and, if there is a large enough collar for the plate to screw against, the ordinary screw thread will be all that is needed to bring it true on the face. But I have found by repeated trials that such a thread will not always bring the face-plate concentric with the spindle. I think the usual cause of this is the dirt which will unavoidably get into the thread in the plate; I have tried squaring the end of the starting thread of the spindle to clean the dirt out of the thread, but not with entirely good results. A groove cut in as suggested by "A Mechanic" would be better, but I doubt if that would keep the thread completely clean, and if it does not, then a 45° angle thread will not be as good as the common one.

Some of the fixtures that are used on lathe spindles must be concentric, and in that case I have not heard of any plan which promises any better results than the plain taper and a straight thread, which thread may just as well be a square one, for all it has to do is to force the taper spindle into place. The sole reason that the taper fit would be better is because it is very much easier to keep the taper parts clean than the thread inside a fixture.

Where more than one fixture is used on a spindle, the one that gets loose from frequent use can be fixed by facing a little off the hub of it, instead of facing off the spindle collar. BELL CRANK.

The Schiele Curve.

Editor American Machinist:

In your issue of January 15, 1891, Mr. William H. Harrison takes Messrs. Lane, Schiele and Peacock to task on the so-called anti-friction curve. Although I haven't any higher opinion of the practical value of this form of bearing than Mr. H. has, still I think he is a little severe in his judgment of the inventor. I am not personally acquainted with Schiele, but I don't think he ever had the cheek to offer this form of bearing as one without friction, or one that would never wear out, but as one which would, in the process of wearing, *retain the original shape*, both of the external and internal members, which would seem to be as desirable a feature in millstones as in shaft bearings, although Mr. H. seems to think differently.

Some builders make the bearings of the spindles of lathes and other machine tools of a form which they style "an approximation to the anti-friction curve," which might be all right if the pressure were *all end thrust*, which it isn't by a large majority in a lathe on the general run of work, and I don't think Schiele ever claimed that his bearing was suitable where there was any side pressure worth speaking of.

WALTER GRIBBEN.

Step Bearings.

Editor American Machinist:

In your issue of Jan. 1st Mr. Lane described a vertical step bearing which he designed for a pressure of about 3,000 pounds. In your issue of Jan. 15th this bearing called out a criticism by Mr. Wm. H. Harrison, which seems to me to be about to the point.

The writer has made many step bearings of a sectional area of not over one inch, for carrying mill stones and other equally heavy work, and at even greater speeds. These bearings were all well enough in their day, also the bearing described by Mr. Harrison. We have in our works many machines which have an end thrust which is equal to more than twice the amount of the weight which Mr. Lane designed his step to bear. Since making the bearing of the right form and material, we have never had a particle of trouble with their working.

In making a good ball step bearing, it is simply necessary to have practically perfect spheres and hard surfaces for the balls to travel on. A step made in this manner, with one oiling, will run a year. The saving in power, caused, of course, by the saving in friction, has not yet been determined accurately to my knowledge, although we are able to see a very great saving over any convex washers.

In case you wish to adjust the shaft, if it should wear a trifle out of plumb, the step bearing being made perfectly flat, it is easy to move it a little to throw it into line without materially affecting the ball bearing. I should be pleased to send any one interested a blue print of these step bearings as we now make them.

I am not a believer in the spherical form of step bearing as proposed by Mr. Harrison; have had no end of trouble in mill steps with this form, which, when changed to a perfectly flat surface, with cross gutters for a free flow of oil, has always worked to perfection.

In relation to a side bearing of the shaft, would say that the side bearing may be arranged in the step, and be made a ball bearing, as well as having it further up the shaft, as Mr. Harrison proposes.

JOHN J. GRANT,
Supt. Simonds Rolling Machine Co.
Fitchburg, Mass.

Director-General Davis, of the Columbian Exposition, is doing some good work for the great fair, and he is also doing some unseemly talking on the subject that does not help the project a bit. The declaration that "It will be the greatest world's exposition ever held" had better been left unmade for a year or two at least. People are not enthused in these times by such talk; on the other hand, it is likely to have a contrary effect. Quiet work, and a plain statement of what has been accomplished is what counts. We hope it will be the greatest fair ever held, but talk will not make it so.

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CONTENTS.

	PAGE.
Improved Drill Presses	1
Convenience in the Machine Shop. By A Mechanic	1, 2
Polishing Wheels. By F. H. Treacy	2
Sketches of an Apprenticeship. By W. S. Rogers	2, 3
A New Tapping Attachment	3
Raced with the Engine	3
A Matter of Interest to Manufacturers	3, 4
Improved Screw Machine Turret Lathe	4
Shop Notes	4, 5
Letters from Practical Men: The Ideal Shop. By Fred. H. Colvin—A Boring Bar. By Makeshift—Don't Draw Them. By Wm. Haddow. A Large Engine—A Hint on Filing—Countersinking for Screws. By X—Why Good Machinists will not Serve in the Navy. By An Honorably Discharged Machinist—"Vacuum Chamber" in Suction Pipe for Pumps. By J. C. Gustafson—Molding Web Pulleys. By K.—Hardening Steel. By Box 13—Lathe Spindle Screws. By Bell Crank—The Schiele Curve. By Walter Gribben—Step Bearings. By John J. Grant	6, 7
Rapid Transit in Sight	8
Questions and Answers	8, 9
Manufactures	9, 10
Safety Water Column	11
Idle Steamships and Engineering	11
An Ancient War-ship	11
Manufacture in the South	11
Signaling at Sea	11, 12
Machinists' Supplies and Iron	12

Rapid Transit in Sight.

To judge from present indications, it seems probable that New York City will have an improved system of rapid transit, and that some practical steps will be taken towards it before many months. The necessity for it has grown steadily more and more apparent, as has also the fact that the people who are interested in securing it must take such action as will convince the politicians and wire pullers that rapid transit must come, and that those who stand in its way will get the worst of it.

A number of schemes have been proposed, and most of them were presented by invitation to the Rapid Transit Commission a few days ago, some of them being old and familiar, and others new. What seems the most promising, however, in our opinion, was the one presented by Mr. Louis Sterne, who was originally an American machinist, but has for some years been in England, where he is carrying on a manufacturing business. He came over to explain here the merits of what is known as the Greathead system of underground tunneling, which has now been in use for some time in London, and the nature of which is made plain by our extract from the *Pall Mall Gazette*, which we published Jan. 8. The Hudson River tunnel is now being cut through between this city and the New Jersey shore in this way, and, by reason of the adoption of this system of tunneling, seems much more likely to be completed than ever before in its history. The universal testimony of those who have had opportunities for forming a judgment of the City and South London Electric Railway is that it is in every way a good road, and fully meets the requirements for which it was constructed.

The outline of the scheme proposed for New York, as explained to us by Mr. Sterne, consists first in securing along the line of the proposed road, by lease or purchase, buildings already erected and situated at proper distances for stations. Working inside these buildings, vertical shafts will be sunk to a depth of about 60 feet from the surface of the ground, and from the bottom of these shafts headings will be forced through each way, joining in the center, when the tunnel will be complete. We are not informed just what distance it is proposed to have between stations, but assuming it to be one-half mile, then the time required to construct the tunnel would be only that which would be consumed in sinking one shaft, and constructing the tunnel for one-half the distance between it and the next shaft, since, if necessary, work could be carried on in both directions from each tunnel. Of course, to put it through at this rate would require a very large outlay for machinery, since a double set of shields, hydraulic presses, etc., would be required for each tunnel, and such an outlay might not be warranted unless it were certain that other contracts requiring the use of the same machinery could be secured. But at any rate, it is proposed to work enough headings simultaneously to complete the tunnels in one year from the time of commencement, which will be exceedingly quick work for an undertaking of such magnitude.

The buildings from which the tunnels are sunk will then be used as stations, or such part of them as may be necessary for that purpose, the balance of them being let for business purposes, for which they would, of course, be especially valuable. In the shafts would be two large elevators for conveying passengers up and down about fifty at a time; one elevator coming up while the other is going down.

It will be necessary in New York to provide for two classes of trains—accommodation trains, which shall stop at every station, and express trains, making few stops, and running at a high rate of speed. It is proposed to provide four separate tracks, one for trains of each class in each direction, and either there will be two tunnels, each large enough for two tracks side by side, or there will be four tunnels, two of which will be side by side above the other two. At this depth no obstacles will be encountered, and the foundations of buildings will not be in the least disturbed, as was proven in London. The temperature of the earth at this depth is practically uniform, and it will, therefore, be easy to keep the temperature of the cars also uniform.

As to the form of motor to be adopted, electricity seems to have the most points in its favor, though we do not think, as some of the electrical enthusiasts seem to, that no other system has enough merit to entitle it to consideration. Steam locomotives would be objectionable on account of the steam and products of combustion which would be thrown into the tunnel. A cable we do not think can be operated at a sufficiently high rate of speed. A locomotive using compressed air might answer, especially if it were found necessary to force air into the tunnels for ventilation.

The Greathead system of tunneling, however, is not confined to, nor, so far as we are aware, even especially adapted to the use of any certain form of motor rather than another, though electricity is used in London, and, we understand, with entire satisfaction.

The main point is that a satisfactory system of rapid transit can in all probability be provided by this system more quickly and more cheaply than by any other means known at present.

It is believed that the greater part of the tunnels will pierce through solid rock, but the rock is of such a character that it is not difficult to cut through; drilling hard, but coming down by blast easily.

As the shields progress, the cast plates composing the tunnel are bolted together in position, and cement is then forced in around outside of them until all interstices are filled up solid, thus making an air-tight tunnel and one which will keep out all water and gases.

There have been some objections to underground traveling on account of its supposed necessarily gloomy and generally unpleasant features, but the City and South London Railway is universally conceded to be a pleasant road to travel upon, the tunnel itself, as well as the cars, being brilliantly lighted by electricity and thoroughly ventilated, and a fact such as this counts for much more than all the imaginary difficulties which can be brought up.

It seems probable that the manufacturers of steel rails have now got things in shape so that prices can be pretty well regulated during the coming year, and it is reported that there is practically a contract among the comparatively few men who now control the business in this country not to sell under $30 per ton, which is about $3 above the price at which they have been selling for some time past. This has been accomplished by the gradual buying up of one concern after the other until there are now few enough of the large concerns to hold together. Of course if they can control prices perfectly to the extent indicated, it is probable that they may try to raise them still higher should the condition of business seem to warrant it, and the development and building of new roads will, of course, be correspondingly retarded, as they would be by any other unavoidable increase in the cost of construction.

The success of the social feature of the House Warming of the Mechanical Engineers' Society has led to the expression of a general desire for more of such reunions, and the first of these will take place on the evening of Thursday, the 29th. Those who attend are urged to be in the auditorium by 8.30, where they will be entertained by Mr. H. H. Suplee, of Stamford, who will throw upon the screen a number of photographic lantern slides of views taken during the European trip of the engineers in 1889. There will also be music. The expense of this and subsequent social reunions, which it is proposed to hold on the last Thursdays of each month, will be borne by those who participate in them, each man attending being expected to contribute $1, which payment entitles him to bring his ladies with him without additional charge. The money thus received is calculated to recoup the society for all its outlay, so that the participants not only pay their own way but do something as well towards defraying the regular expenses of the society, and thus help to bear the burden of those who, by reason of distance from New York, are unable to attend.

There is little doubt that these reunions of members and their ladies may be made to do much more than simply afford pleasure to those who attend them. By promoting acquaintance and sociability they may do much to promote the cordial friendship and good feeling which go far towards making such a society stronger by reason of the personal friendships formed among the members.

Those who live at a distance from the city are especially urged to so time their visits here, so far as possible, as to be present on the last Thursday of the months from now until April.

A switch engine of the elevated road was run into the other day by a regular train and forced off the structure to the ground. No one was very seriously injured, the enginemen of the switch engine having jumped to the track when they saw that a collision was inevitable. The accident was followed by the usual unwarranted criticisms on the management of the road, by the newspapers, and the fact that no one was killed attributed entirely to good luck. The hard fact is, however, that the New York elevated roads constitute an example of the very best railroad management to be found in the world. It is not good luck, but excellent management which enables these roads to handle such vast numbers of passengers with such a very small number of accidents. New York has outgrown the elevated railroad system, and must evidently have a better system of rapid transit; but that is ro reason why everything connected with the roads should be condemned without discrimination. The engines and machinery of the road are not worn out and in bad repair, but, on the contrary, are kept in good order; its structure is not a ramshackle affair, but a good and substantial one of its kind, and in the main those who manage it are doing about as well as they could be expected to do with such a road. This does not refer to the accommodations afforded those who travel upon them, but only to the work of the mechanical and operating departments, which is excellent.

Electricity for operating surface railways has come to stay, if it can only be used properly. And this remains with the electric companies to settle. If there is no other way to compass the end sought than the use of the poles and overhead wire—a constant menace to life—then we ought to wait patiently till something better is devised. Such an arrangement is a mechanical monstrosity, and seems to be born of the desire to do things cheaply.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(49) Reader, Brooklyn, N. Y., writes: I am building a steam engine with a cylinder 1½ inches diameter, stroke of piston, 3½ inches. What should be the size of ports and width of bridges? *A.*—Steam ports, $\frac{3}{4} \times \frac{3}{16}$; exhaust ports, $\frac{3}{4} \times \frac{3}{8}$; width of bridges, ¼ inch.

(50) A. B., Beaver Falls, Pa., asks: If it takes a pressure of 165 pounds per square inch in testing a boiler with cold water, how many pounds pressure will it require for testing the boiler with steam to show the same effects? *A.*—Generally there is no difference made in test pressures of boilers; the same pressure is used for steam as is used for cold water, although the effect will not be exactly alike in the two tests.

(51) W. H. C., Deering, Me., writes: Kindly inform me what is the smallest size of cylinder with which I can drive a boat of fairly good lines, twelve or fourteen feet in length, at a speed of about five miles per hour, using steam of one hundred pounds pressure; also give size and pitch of screw. I prefer the engine and boiler to occupy as little room as possible, rather than the boat shall make any great speed. *A.*—Diameter of cylinder, $1\frac{3}{4}$ inches; stroke, $2\frac{1}{2}$ inches; diameter of propeller, 10 inches; pitch, 18 inches.

(52) D. H. B., Brookfield, Mo., writes: Please tell me what the natural flow of water will be through a one-inch pipe, one foot long. I understand that the cross-sectional area of a one-inch pipe is not near one square inch, but say the cross-sectional area does contain one square inch, how many cubic inches of water will flow through this pipe? *A.*—The cross-sectional area of a pipe one inch inside diameter is $1^2 \times .7854 = .7854$ of a square inch; and the diameter of a pipe whose cross-sectional area is one square inch is equal to

$$\sqrt{\frac{1}{.7854}} = 1.128+ \text{ inch.}$$

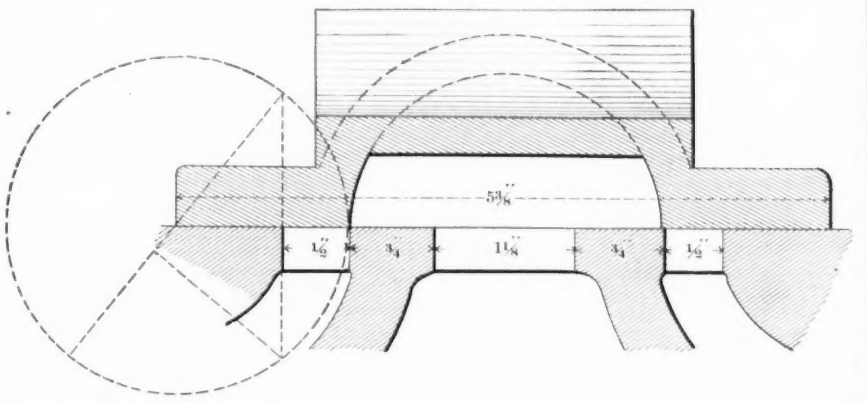
The discharge of water will depend on the head, or, in other words, on the pressure in the pipe. 2. I find in your issue of January 1, that E. D. L. asks what will be the pressure on a $2\frac{1}{2}$-inch safety valve, the boiler pressure being fifty pounds. I think you have made a mistake; I figure it to be 245.4375 pounds, instead of 225.4375 pounds. *A.*—You are correct.

(53) L. A., Baltimore, Md., asks: What is the indicated horse-power of an engine running at 300 revolutions per minute, cylinder 12x9 inches, and cutting off at $\frac{1}{4}$ stroke, boiler pressure 100 pounds per square inch? *A.*—74 indicated horse-power. 2. Is it practical to cut off at $\frac{1}{4}$ stroke with a plain D slide valve in any kind of an engine? *A.*—Steam is frequently cut off at $\frac{1}{4}$ of the stroke, and sometimes earlier, with an ordinary D slide valve. Of course, cutting off early with a valve of this kind will increase the compression, which may be increased to a hurtful extent, if not a sufficient amount of clearance is allowed. 3. Has a locomotive slide valve so much travel as to allow live steam to enter the cylinder when the link is hooked up in midgear? *A.*—Yes. 4. What is the radius of a locomotive link? *A.*—It is the distance from the center of the axle on which the eccentrics are placed to the center of the lower rocker pin when the latter stands in the center of its travel. This applies only to shifting links; for stationary links the radius is made equal to the length of the rod, which forms a connection between the link and the valve stem.

(54) E. H. S., Denver, Col., writes: I am building a small engine; diameter of cylinder is $3\frac{1}{2}$ inches; stroke, $7\frac{1}{2}$ inches; number of revolutions, 150 per minute; boiler pressure, 60 pounds; cut-off at $\frac{3}{4}$ of the stroke. What should be the size of the steam and exhaust ports? I intend to use a piston valve. *A.*—The piston valve should be $1\frac{1}{8}$ inch diameter, and for this diameter of valve the steam ports should be $\frac{1}{8}$ inch wide, and exhaust ports $\frac{1}{4}$ inch wide. We do not see what you can gain by using a piston valve for so small an engine; it will make the cylinder casting unnecessarily complicated, and the ports too narrow for obtaining a good casting. For an ordinary slide valve the steam ports can be made $1\frac{3}{8}$x$\frac{1}{4}$ inch, and the exhaust port $1\frac{3}{8}$x$\frac{1}{2}$; with ports of this kind a good cylinder casting can be obtained with considerable less labor. 2. What should be the diameters of the steam and exhaust pipes? *A.*—Steam pipe, $\frac{3}{4}$ inch diameter; exhaust pipe, 1 inch diameter. 3. What should be the diameter and weight of fly wheel? *A.*—Outside diameter, 34 inches; weight, 300 pounds. 4. What size of belt can I use for this engine? *A.*—The size of belt will depend on its velocity; at 750 feet per minute you may use a 2-inch belt.

(55) W. J. B., Rochester, N. Y., writes: Please give me the dimensions of a single compound condensing engine for a well-designed yacht 40 feet long, 6 feet wide, to run fifteen miles per hour. Steam pressure, 160 pounds; number of revolutions, 250 per minute; boiler of the water tube type. What I want to know is size of cylinders; size of valves and ports; cut off; size of boiler for natural draught, and also for forced draught; diameter and pitch of propeller. *A.*—The size of engine and boiler will of course depend on the draught, and on the lines of the boat, and since we know nothing of these, we can only give the approximate sizes. Diameter of high-pressure cylinder, $7\frac{1}{2}$ inches; diameter of low-pressure cylinder, 15 inches; stroke of both pistons, 9 inches. Cut-off in high-pressure cylinder at .4 of the stroke. The area of the steam ports in the high-pressure cylinder should be 3 square inches; and that of the low-pressure cylinder, 9 square inches. The size of the valves is determined by the instructions given in our issue of May 1, page 5, 1890. For natural draught the boiler should have 14 square feet of grate surface, and 440 square feet of heating surface. For forced draught there should be 8 square feet of grate surface, and 300 square feet of heating surface. These sizes are for soft coal; for hard coal an increase of 50 per cent. will be required. Running the engines at 250 revolutions per minute, you will need a propeller 4 feet diameter and 7 feet pitch. This propeller is too large for a 40-foot yacht; we should therefore advise to increase the speed of engine, which will enable you to reduce the size of propeller. Of course, in increasing the speed of engines the cylinders may be made smaller.

(56) F., New York, writes: A party of engineers would like very much to have an illustration of the statement made in your answer to Question 428, in your issue of November 6, 1890. It reads: "Or, in other words, we may say that the power of a compound engine depends on the size of the large cylinder, and is the same as that which would be obtained from a single cylinder of the same content by expanding to the same extent from a like initial steam pressure." *A.*—This can be proved by an analytical process, but it is a somewhat complicated one. The following reasoning is simpler, and it may make the correctness of our statement sufficiently plain. Assume that in a cylinder of a simple engine the steam is



expanded from a given initial pressure to a given final pressure at the end of the stroke. If we use the same quantity of steam in a compound engine, and expand it from the same initial pressure to same final pressure as in the simple engine, it is reasonable to assume that both engines will develop the same indicated horse-power. Now in a compound engine the final pressure occurs at the end of the stroke in the low-pressure or large cylinder, and since this cylinder must contain at the end of the stroke the whole quantity of steam taken by the engine during the stroke, it follows that the low-pressure cylinder must have the same capacity as the simple engine cylinder, and if the stroke is alike in both engines the diameters of the cylinders must also be equal, hence for equal indicated horse-powers the low-pressure cylinder of the compound engine must be of the same size as the cylinder of the simple engine. This reasoning indicates that, in order to find approximately the indicated horse-power of a compound engine, we may assume its power to depend on the size of the low-pressure cylinder, and in making the computation we take into account this cylinder only, and use the same rules as are employed for finding the indicated horse-power of a simple engine having a cylinder of the same size as the low-pressure cylinder of the compound engine, using the same initial steam pressure, and the same rate of expansion. The high-pressure cylinder should only be regarded as a stepping-stone in the expansion.

(57) Inquirer, Litchfield, Ill., writes: I am contemplating building a slide valve engine. Enclosed you will find a sketch of slide valve. Its principal dimensions are as follows: Lap, $\frac{7}{8}$ inch; width of steam ports, $\frac{5}{8}$ inch; length, 8 inches; width of exhaust port, $1\frac{9}{16}$ inches; width of bridges, $1\frac{1}{8}$ inches; inside lap, $\frac{5}{32}$; diameter of cylinder, 9 inches; stroke of piston, 14 inches; revolutions per minute, 150. Kindly examine the drawing and give me your opinion as to their correctness, and give such correction as you may deem to be advisable. And, if it will not take up too much space in your columns, please give simple rules for obtaining the dimensions. *A.*—The area of the steam port is found by the following rule: Multiply the area of the piston in square inches by the speed of piston in feet per minute, and divide the product by 6,000; the quotient will be area of steam port. The area of a piston 9 inches diameter is 63.61 square inches; the piston speed is $\frac{14 \times 150 \times 2}{12} = 350$ feet per minute. Hence, according to rule, we have $\frac{63.61 \times 350}{6{,}000} = 3.71$ square inches for the steam port area. Adopting 8 inches for the length of the ports we have for the width of each steam port $\frac{3.71}{8} = .463$, say, $\frac{1}{2}$ inch. This shows that your steam ports are $\frac{1}{8}$ of an inch wider than necessary. Some stationary engine builders make the steam port area a little larger than that found by the foregoing rule, but we believe that a port 8x$\frac{1}{2}$ inches will be sufficient. The bridges we should make $\frac{3}{4}$ inch wide, and exhaust port $1\frac{1}{4}$ inches wide. The method for finding the width of exhaust port has been explained in our issue of May 1, 1890. The outside lap which you have adopted is correct. It will cut off at about $8\frac{1}{2}$ inches of the stroke; but your inside lap we believe to be excessive; $\frac{1}{16}$ inch will be sufficient. We prefer to make the travel of the valve equal to twice the sum of the lap and width of steam port; that is, $2 \times (\frac{7}{8} + \frac{1}{2}) = 2\frac{3}{4}$ inches. The accompanying section shows the principal dimensions of the valve as we should make it. 2.—Please give rule for computing the dimensions of the crank-pin for this engine; the steam pressure is 80 pounds per square inch of piston. *A.*—The rules given by authorities are very conflicting. Probably the best way to proceed is first to find the diameter of the pin by the following rule: Multiply the square root of the maximum pressure in pounds on the piston by .03; the product will be the diameter in inches of the pin. According to this rule we have $.03 \sqrt{63.61 \times 80} = .03 \times 71.3 = 2.139$; say $2\frac{1}{4}$ inches. For stationary engines, the pressure on the crank-pin should not exceed 800 pounds per square inch of projected area. The total pressure on the piston is $63.61 \times 80 = 5{,}088.80$ pounds, and $\frac{5{,}088.80}{800} = 6.36$ square inches for the projected area. The diameter we have found to be $2\frac{1}{4}$ inches; hence the length will have to be $\frac{6.36}{2.25} = 2.82$; say $2\frac{7}{8}$ inches. Many engineers will use for this engine a crank-pin $2\frac{1}{4}$ inches diameter and $2\frac{1}{2}$ inches long. The foregoing relates only to overhung crank-pins. 3.—What size piston rod and crank-shaft would you use? *A.*—Diameter of piston rod, $1\frac{1}{2}$ inches; diameter of crank-shaft, 4 inches.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's (1891) gear catalogue ready. See adv. p. 20.

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Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

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I. S. L. drawing stands. The original. For particulars and prices, address W. S. Rogers, Troy, N. Y.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Send to H. W. Knight & Son, Seneca Falls, N. Y., for catalogue of pattern letters and figures.

Audubon Machine Works, New Haven, Ct. Electrical work, superior facilities, builders of machinery, heavy and light.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Dec. 18, p. 18. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

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Hawkins' Calculations, for engineers, firemen and machinists. Send 25 cents for Part I, and subscription blank for whole issue, 10 parts (bound vol. $2.50). Theo. Audel & Co., 91 Liberty St., office 3.

Second-hand machinery for any purpose bought and sold on fair terms. Address, with particulars, J. H. Blake, 12 Cortlandt street, New York.

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"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

Henry Turlington, Clinton, N. C., will erect a machine shop.

The Bowling Green (Ky.) Woolen-mills will enlarge their mill.

The establishment of a woolen-mill is projected at Kerrville, Texas.

An electric light plant is reported as to be erected at Madisonville, Ky.

The Salem Iron Works will, it is stated, erect new works at Salem, N. C.

There is a prospect of an iron foundry being built at Weatherford, Texas.

A foundry will be erected at Columbia Heights, S. C., by Miller Brothers.

Johnson & Co., are reported as building new iron works at Manchester, Va.

The Gogebic Boiler Works, at Duluth, Minn., will soon double their capacity.

R. F. Divver is enlarging, it is reported, his machine works at Anderson, S. C.

The Peninsular Car Works, of Detroit, Mich., will probably be removed to Seattle, Wash.

A large steel plant may be built in South Bristol, Tenn., by a combination of corporations.

A large foundry will be built on Webster's Island at Old Town, Me., by T. M. Chapman's Sons.

The Smead Foundry Company, Toledo, O., has been incorporated, with a capital of $80,000.

A stock company is reported as being organized to erect another cotton-mill at Hickory, N. C.

The King Hardware Company has been organized at Anita, Iowa; capital stock $6,000 to $10,000.

A cotton gin and seed-oil-mill are to be erected at Skidmore, Texas, before the next season opens.

The erection of an ice factory is projected at Holly Springs, Miss. T. N. Walden is interested.

A. R. DeAlba will, it is stated, organize a stock company to erect an ice factory at Buchanan, Va.

It is rumored that a stock company will be organized to erect another ice factory at Covington, Ky.

The Jefferson (Tex.) Woolen-mills Company is reported as to put new machinery in its woolen-mill.

Edward Rasch & Bro., Florence, Ala., contemplate increasing the capacity of their iron railing works.

The Argonaut Cotton-mill Company, Covington, Ky., is to place $100,000 worth of new machinery in its mill.

It is stated that the Bealle Coupler Company, at Birmingham, Ala., will enlarge their car coupler factory.

The Florence Ice Company, Florence, Ala., is reported as to put a 10-ton ice machine in its ice factory.

The Canton Malleable Iron and Manufacturing Company is a new concern at Canton, Ohio; capital $100,000.

The Manchester Manufacturing Company, of Macon, Ga., will put additional machinery in its cotton-mill.

The Jenifer Iron Company will, it is stated, make extensive improvements to its iron furnace at Jenifer, Ala.

J. M. McCreary is reported as to erect an iron foundry and machine shop at Senoia, in Coweta County, Ga.

The machine shops of the Illinois Central Railroad Company, recently burned at Water Valley, Miss., will be rebuilt.

A stock company, with a capital of $25,000, is building a brass foundry and machine shop at Middleville, Mich.

The St. Louis (Mo.) Expanded Metal Company contemplates the establishing of metal works at Fort Worth, Texas.

The Bates Machine Company, of Joliet, Ill., are building a large pattern shop on the grounds occupied by their works.

The Buckeye Manufacturing Company, of Pittsburgh, Pa., employing 500 men, will locate at Stauffers, near Scottdale, Pa.

A company with a capital stock of $50,000 is being organized at Greenwood, S. C., to erect machine shops and repair shops.

The capital stock of the Jenckes Machine Company, Sherbrooke, Quebec, Can., has been increased from $75,000 to $100,000.

R. H. Woodsum & Co., of East Braintree, Mass., tack manufacturers, are preparing to move their plant to South Braintree.

Work on the bending-mills at Piedmont, Ala., has been commenced. The plant covers two acres in the eastern part of the city.

W. H. Phillips, of Taunton, Mass., will, it is reported, probably remove his foundry and machine shops to Middlesborough, Ky.

The Crefeld Mills, Westerly, R. I., are going to put in new boilers and extend the mill in the spring, and also add more machinery.

The Planters' Oil-mill and Manufacturing Company contemplates putting an electric light plant in its oil-mill at Greenwood, Miss.

The Norfolk & Western Railroad Company's car wheel works at Roanoke, Va., will employ two hundred men when completed.

The Covington Improvement Company is negotiating for the establishment of a nail-mill at Covington, Va., also for a muck-bar-mill.

A fine sugar-mill with all the latest improvements is being fitted up in Pittsburgh, Camp County, Tex. The mill will soon be in operation.

The Covington Improvement Company, Covington, Va., is negotiating for the establishment of a nail-mill and muck-bar-mill at that place.

The South End Improvement Company is negotiating for the establishment of cotton-mills, iron works and other industries at Salem, N. C.

There is water-works agitation in Blue Springs, Neb.; Cordele, Ga.; Milford, Del.; Zanesville, O.; Sheffield, Ala.; Huntsville, Ala.; St. Louis, Mo.

The new manufacturing plant of the Michigan Railway Supply Company, at Detroit, Mich., is nearly completed. The main building is 75x300 feet.

The Old Dominion Iron and Nail Works Company, Richmond, Va., contemplate the early improvement and enlargement of their iron and nail works.

The Houston & Texas Central Railroad Co. (office, Houston,) will, it is reported, locate at Ennis, Tex., machine shops and roundhouse, at a cost of $500,000.

The Midland Foundry Company has been incorporated at Chicago, Ill., with a capital stock of $20,000, to do a general foundry and machine business.

The Shelby Weldless Cold Drawn Steel Tube Company have been organized at Shelby, O., with a capital of $100,000, to manufacture cold drawn steel tubes.

W. J. Hammond & Sons, of Pittsburgh, will erect a new sheet-mill at Mansfield, Pa., the citizens of that place having donated a 20-acre site for the works.

The new rolling-mill of the Fort Worth Rolling-mill Company, at Fort Worth, Texas, is nearly completed. This company has a cash capital of $50,000.

The Hall Machine Company will in the spring commence the erection of buildings in Deering, Maine, with capacity to give employment to 300 or 400 men.

It is reported that the Griswold Cotton-mills, Turner's Falls, Mass., are about to put in a lot of new machinery, and nearly double their present capacity.

T. T. Hillman, G. L. Morris and W. A. Walker will petition the legislature to incorporate the Southern Steel Company, to operate a steel plant at Birmingham, Ala.

J. H. Huiett, L. D. Cullum, N. A. Bates and others have incorporated at Batesburg, S. C., the Batesburg Manufacturing Company, with a capital stock of $5,000.

The A. T. George Spring Motor Company, corporation has been formed to manufacture spring motors for street cars of Kansas City, Kansas, and Kansas City, Mo.

The Clyde Iron Works, of Duluth, Minn., will shortly add to their capacity by the introduction of new and improved machinery throughout their entire plant.

The Dennison Cotton Factory at Dennison, Texas, is fast nearing completion. It will employ 600 hands, and, it is said, will consume 9,500 bales of cotton annually.

The Maxton Manufacturing Company, recently incorporated at Maxton, N. C., with a capital stock of $50,000, will build and operate machine works and iron foundry.

The Pacific Mills, at Lawrence, Mass., are rearranging their machinery preparatory to putting in a plant to cost $50,000, for the manufacture of fine worsted yarns.

The Old Dominion Iron and Nail Works Company of Richmond, Va., will, it is reported, improve its iron and nail works, put in a new gas plant and an electric light plant.

The Stevens Electric Company, Birmingham, Ala., has, it is stated, increased its capital stock to $50,000, and contemplates putting additional machinery in its electric light plant.

The Hogan Refrigerator Car Company, of Chicago, has been incorporated, for the manufacture of refrigerator cars; incorporators, E. J. Johnson, Annetta Woodward and H. R. Pearson.

At Prescott, Ark., the Prescott Hardware Company has been incorporated, with J. M. Milborn, president; A. M. Denman, vice-president, and T. Pittman, secretary; capital stock, $20,000.

The Monitor Pipe Works, of Elizabeth, N. J., will remove their plant to Sing Sing, N. Y., early in the year. The move is made in order to secure better shipping facilities than the works now enjoy.

We are in receipt of a letter, says the Pittsburgh (Camp County, Texas) *Gazette*, from a firm who proposes to put up a barrel factory at Pittsburgh, if they can be satisfied the investment will pay.

A company composed of parties from Springfield, Ohio, Kansas City, Mo., and Sherman, Texas, are at Corsicana, Texas, looking to the establishment of machine shops and stove works in that place.

The Elmira Steam Generator Company was recently organized and incorporated at Elmira, N. Y., with a capital of $60,000, to manufacture steam generators and other appliances of a similar nature.

The Adams & Price Locomotive and Machine Works, Nashville, Tenn., have nearly finished building to compensate for the fire of last fall. The new buildings will give them largely increased facilities.

A new company has been formed, and will be chartered, to operate a bridge and boiler works at Bellaire, Ohio. The company includes some practical men, and others, with means to carry on the business.

The iron foundry and machine shop of Beeson & Helleneck, which was destroyed by fire at Fairmont, W. Va., in September last, is to be built and operated by a new company, who will have a capital stock of $100,000.

The Greenville Land and Manufacturing Company, Greenville, Miss., proposes to erect the cotton factory and ginnery for which it was previously reported as negotiating. The estimated cost of entire plant is $100,000.

The Indianapolis Car Works, at Indianapolis, Ind., have been purchased by a syndicate of creditors, represented by Edward Pollock, of Cincinnati, O., for $52,500. The purchasers propose to resume the operation of the plant.

The Quebec Machine and Foundry Company, with headquarters at the city of Quebec, Can., will be incorporated, with a capital stock of $30,000, to carry on the business of iron founders, machinists and general workers in iron.

The Greenville Land and Manufacturing Company, of Greenville, Miss., proposes to erect itself the cotton factory and ginnery for which it was previously reported as negotiating. The estimated cost of entire plant is $100,000.

The Shenandoah Brass and Iron Works has been incorporated at Charlestown, W. Va., by C. A. Stephens, of New York; Edmund Ault, of Booneville, N. J.; F. W. Brown and others. The maximum capital stock is $60,000.

Articles of incorporation have been filed by the Northwestern Engineering and Machinery Company, of St. Paul, Minn. The capital stock is $50,000, and the incorporators are Charles A. Daigh, W. G. Strickland and J. M. Badger.

The Chesapeake & Ohio Railroad Co. (office, Richmond,) will, it is reported, make extensive improvements to its roundhouse and machine shops at Clifton Forge, Va., at a cost of about $100,000; also put new machinery in the shops.

The Drexel Car Coupler Company, of Chicago, has been incorporated, for the manufacture and sale of car couplers and railway appliances; capital stock, $600,000; incorporators, William A. Alexander, A. C. McCord and D. W. McCord.

It is reported that the Mahoning Valley Iron Company, Youngstown, Ohio, will extend their plant by the erection of a puddle-mill containing 10 double puddling furnaces, thus increasing their production of muck bar 50 tons a day.

A. N. Hitts, of Carter's Springs; Thomas Lumken, of Cartersville; C. J. Kicklighter and others, are organizing the Southern Farm Tool Company, to manufacture implements, machinery, etc., at Atlanta, Ga. The capital stock is $100,000.

The rolling and muck-bar-mill, which was recently reported as to be erected at Salem, Va., will be moved from Newport, Ky., and operated by a $150,000 stock company. The Salem Development Company has signed contract for its removal.

The Ryan-McDonald Manufacturing Company, of Waterloo, N. Y., are to remove their machine works to Curtis Bay, Md., where a company with $100,000 capital stock will be incorporated, and where a building 350x70 feet will be erected.

A new interest is starting up in Ottawa, Can. The old Baldwin foundry, having lain idle for some months, has recently been acquired by Messrs. George Roe and Robert Graham, who will run it under the style of the Baldwin Iron Works.

The Simonds Rolling Machine Company, Fitchburg, Mass., are employing 112 men, and are at present between five and six million balls behind their orders. Their increased facilities will, however, soon put them even with this deficiency.

The Chicago Steel and Specialty Company, of Chicago, Ill., has been incorporated, with a capital stock of $300,000 for the manufacture of steel and iron and their products. The incorporators are: Harold Sturges, J. S. Ralston and Frank S. Betz.

The Hayden & Derby Manufacturing Company, 111 Liberty street, New York City, sole manufacturers of the Metropolitan automatic injectors, write us: We are pleased to say that our business is larger than ever before, and constantly increasing.

New repair shops are being erected at Nicetown, Pa., by the Philadelphia & Reading, to take the place of the old shops at Third and Berks streets, in Philadelphia. The new building will be 307x176 feet, with an extension 25x36 feet; construction has begun.

L. B. Rogers, B. G. Smith, T. C. Moody and others are corporators of the Latta Tramway & Mill Co., Latta, S. C. The company has for its purposes the erection of lumber-mills, machine shops, etc.; capital stock, $10,000, with privilege of increasing to not more than $500,000.

The Columbia Steel Car Company will soon begin work on the construction of its buildings at Riverview, on the Desplaines River, about two miles south of Desplaines, Ill. The main building will be 148x660 feet in dimension, and the works will have a capacity of from 15 to 20 steel cars a day.

Before the close of the year, the Improvement Company of Llano, Texas, will begin the construction of a 200-ton iron furnace, and they have made arrangements with a Northern firm to establish a stove foundry, to cost not less than $100,000, as soon as the railroad is finished to that point.

The Lacroix Automatic Car Wheel Company has been incorporated, at Chicago, Ill., for the manufacture of automatic car wheels and other running gear for railway cars. The concern's capital stock is $1,000,000, and its incorporators are: Frank H. Cooper, John A. Lacroix and Augustus Biswanger.

A large tire mill is being constructed at Youngstown, Ohio, for the Latrobe Steel Works, which will roll a tire from the size of the largest locomotive to that of a small car wheel. The mill weighs 100 tons, contains seven hydraulic cylinders, and will be driven by a pair of 1,400 horse-power engines.

The St. Louis (Mo.) Wire-mill Company recently held a meeting, and increased the capital stock from $300,000 to $500,000, the extra issue of stock being taken by the present stockholders. The increase is for the purpose of erecting new office buildings and warehouses, and putting in new machinery.

The real estate of the Huntingdon Manufacturing Company, in Huntingdon, Pa., was bought in on January 8th by the Iron Car Equipment Company, of New York, subject to a mortgage of $40,000. The new company now has control of the entire plant, which will be enlarged and operated on an extensive scale.

The Springfield Gas Engine Company has been organized at Springfield, Ohio, and will commence the manufacture of an improved gas engine a soon as a plant can be put in running order and patterns completed. Peter T. Coffield, Chas. H. Palson, John H. Rogers, R. H. Rogers and Addison H. Rogers compose the company.

Prominent capitalists of Milwaukee and the East are reported to have purchased a large tract of land near Milwaukee, Wis., upon which it is proposed to erect large car works, to give employment to 1,000 men. The proprietors of the Milwaukee Car Wheel Works are said to be interested. Work on the buildings is to begin soon.

The Maxton Manufacturing Company has organized at Maxton, N. C., with a capital stock of $50,000, for the purpose of manufacturing machinery of all kinds. An iron-mill will constitute part of the plant. The officers of the company are: John C. McCaskill, president, and J. C. Farrish, vice-president and general manager.

The Essex & Smith Manufacturing Company, recently reported as incorporated at Chattanooga, Tenn., have a capital stock of $30,000, and have elected the following officers: C. W. Smith, president; Henry Essex, vice-president, and W. H. Smith, secretary. The company have selected their site, and will commence at once the erection of machine works for the manufacture of castings, implements and machinery.

The Berlin Iron Bridge Company, East Berlin, Conn., are just completing the new iron and concrete bridge on Broad street, in Stamford, Conn. The bridge is of two spans of 60 feet each, with a 30 foot roadway, and two 6 foot walks. The roadway is of iron buckle plates and concrete, with asphalt pavement. The same company have also just completed the iron roof over the new casting shop of The Montgomery Iron Company, at Port Kennedy, Penn.

A Fall River (Mass.) dispatch says: A letter was recently received from Ashworth Bros., of Manchester, England, closing negotiations for the purchase of seven acres of land from the Globe Yarn-mills, upon which the firm proposes to erect large machine shops for the manufacture of carding and general machinery. The firm has been in correspondence with the Globe Mills' owners, and with persons in Lowell, Nashua, Providence, Lawrence and other New England cities during the past two years, but has finally decided to locate here.

The Great Western Construction Company have been incorporated in Illinois, who propose to build works in Chicago, for the construction of locomotives on a new plan, designed by Hugh B. Walker, a mechanical engineer. The incorporators are Hugh B. Walker, Alfred Skinner and Thomas A. Winham. The chief characteristic of Mr. Walker's design is in the fuel-saving portion of the invention, which he claims results in a saving of 9 per cent. This is brought about by the automatic admission of air to the fire-box by various devices, the principal ones being steam injectors.

The New Process Rawhide Company, Syracuse, N. Y., has received the following letter from the manager of the Scranton (Pa.) Street Railways: I have experimented with most everything in the way of motor pinions, and find nothing that works so satisfactorily as pinions of your manufacture. I am so thoroughly satisfied that the rawhide pinions of your manufacture are the best kind of pinions on the market, that I am equipping all our cars with them, and will not look at any other kind. The first I tried, those without being riveted, ran 15,490 miles, and were to all appearances good for 1,000 miles more.

A number of important improvements are now being made at the Edgar Thomson Steel Works of Carnegie Brothers & Co., Limited, at Braddock, Pa. The older parts of the plant are to be torn down and will be rebuilt, and some extensive additions will also be made. An entire new converting-mill will be erected on the site of the present structure, which has been standing since 1876. The mill for the four new cupolas has been in course of construction for several months, and the castings for the cupolas will now be placed in position. The new blooming-mill will have 40-inch rolls, capable of rolling a 15x17 ingot. No change is contemplated in the furnaces.

The Niles Tool Works (railway, locomotive, car and machine shop equipments), Hamilton, Ohio, write us: Business for the past year was very good, and we turned out more machinery than ever before. We built during the year a number of additions to our works; among others, a new machine shop 50x200 feet, a new foundry 300 feet long, with two 20-ton overhead traveling cranes. We are still crowded for room, and have now under way an addition to the machine shop 101x400 feet; 50 feet in width of this will be a new erecting shop, spanned by two overhead traveling cranes of 25 tons capacity each. The other section will be in two stories, for machine work. This will nearly double our machine shop capacity, and we expect to have plenty of business to keep it going.

Mr. Thomas C. Wood, 15 Cortlandt street, New York, writes us as follows: Having noticed in some of the New York daily papers recently an erroneous report in which an allusion is made to the Ball engine, and its manufacture in the East, I beg you will kindly insert in your paper the following, which you may depend upon as correct: "A number of New York gentlemen have made arrangements with Mr. F. H. Ball, of Erie, Pa., the inventor of the well-known Ball engine, to establish in the East a new works possessing the best modern facilities for building high-class engines. The new company have bought the patents of Mr. Ball, who will sever his connection with the Ball Engine Company, of Erie, and take up this month his residence near New York, where he already has a large acquaintance among our leading mechanical engineers. It is expected that the relations between the Erie and the New York companies will be very close and cordial, since the latter will be a large holder of the stock of the Erie company, who will continue, as in the past, under the presidency of Mr. James McBrier, to use Mr. Ball's improvements under a shop right. This move has been brought about by the great increased demand for the Ball engine, especially for all electrical purposes, and more particularly for street railroads, which, it is well known, require an engine not only of great strength, but of unusual governing power—qualities possessed by the Ball engine in a high degree. Associated with Mr. Ball in the new enterprise, we understand, will be Thos. C. Wood, formerly of the U. S. Navy, later of Skinner & Wood, engine builders, of Erie, Pa., and for several years interested in steam engines in New York."

Mr. Daniel Spence, foreman of the foundry department of the Demorest Fashion and Sewing Machine Company, recently received as a present from the employes and management an elegant gold watch, as a mark of the esteem in which he is held. The compliment was fully appreciated.

Safety Water Column.

The accompanying illustrations show a water column for use on boilers, which, in addition to having provision for the ordinary features found upon water columns, has inside a float connected with a whistle valve so arranged as to make an efficient low-water alarm, all the mechanism for this being attached to the cover in such a way that, when the valves between the column and the boiler are closed, and the cover or cap removed, the entire mechanism, including the float, comes out, and can then be examined, cleaned or repaired if necessary, while the boiler is under steam. The sectional view will make the construction easily understood. The float is of the ordinary type, and operates a valve which is simply a plug of Tobin bronze, having a groove cut around its circumference, this plug being moved up or down by the float as the water level changes, and so arranged as to be opened at the occurrence of low water. The efficiency and working condition of the entire apparatus can be tested at any time by simply opening the small cock at the bottom of the column. It can be connected to the boiler in the manner indicated by the engravings, or at top and bottom if desired, and there is also in the cover a boss tapped to receive the steam gauge pipe, thus making the thing complete, and enabling it to take the place of the ordinary attachments to boiler, which it does at comparatively small additional expense.

Where desired, an additional float and valve are put in, which operate to blow the whistle when the water gets too high, and thus an alarm is sounded when the water line varies either way from the proper height.

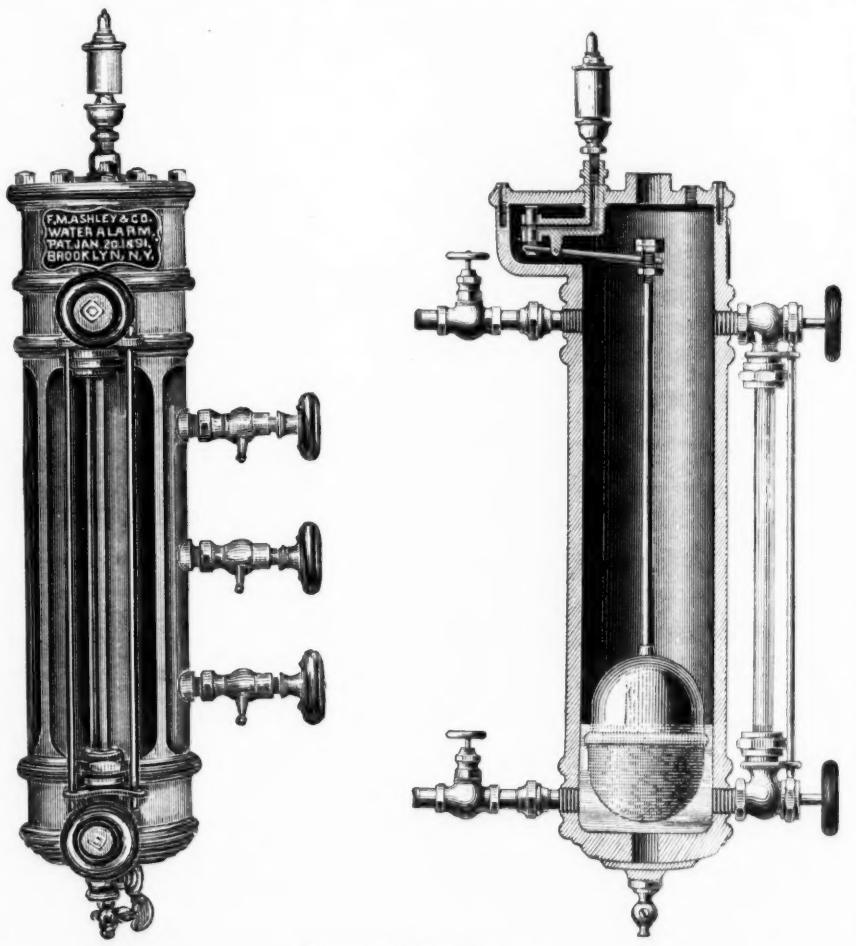
It is manufactured by F. M. Ashley & Co., 1012 Greene avenue, Brooklyn, N. Y.

Idle Steamships and Engineering.

It is believed that at the present time there are 150 steamships laid idle at the various ports of the kingdom, and that the number will be increased before the end of the winter. There is a twofold reason for the idleness—it is partly due to the closing of navigation through frost, and partly because freights have consequently fallen to a point that is unprofitable for all but the most economically working vessels. But already the idleness of so many steamers is beginning to affect some of the freights, and outward rates to the Mediterranean and homeward rates from the United States have risen from the lowest point they had reached. But such an effect will be slow, and it is probable that the large amount of tonnage that has been built during the past two years will tend to keep rates down to a lower pitch than they have been of recent years, and hence economy in the working of steamers will be essential if profits are to be looked for. Whatever may be the effect of the low range of freights on shipping, it is certain that it is quite likely that marine engineers may benefit. The cause of the unprofitable nature of shipping investments just now is that, concurrently with a decrease in the earning power, there has been an increase in the working expenses through the higher price of coal and the higher wages, as well as the long delays of the steamers at the ports. It is evident that the cost of coal is one of the important items in the working expenses, and not only is there the increased cost at the home ports, but the high-priced coal at the foreign ports is also rendered much higher. It is here that the more modern vessels have the advantage, for their coal consumption is so much less that the cost of working is appreciably lower, and thus the vessels with the more modern engines can pay their way with freights at a lower point than can the vessels with older engines and with a larger coal consumption. It is not only that the tonnage of coal used is less, but there is more room for cargo, because it is needless to carry so much coal. It is quite probable that one result of the enforced idleness of so many steamers will be that the marine engineers may receive orders for modern engines from some of the owners of the vessels that are laid idle, and that thus there may be fuller work at the marine engine works. It will be some time before trade turns sufficiently to set the the idle ships at work; but the effect of probably 185,000 tons being laid up for a month or more must be very considerable on the freight market, for it means the withdrawal of facilities for a large amount of traffic, which will be long before it is overtaken.—*London Engineer.*

An Ancient War-ship.

In ancient days there seems to have been built a great war vessel by Archimedes for Hieron, the king of Syracuse, which must have been as unsafe as it was ambitious and extravagant. It was not only a fighting ship, but it possessed even more splendor than the most sumptuous American steamboat. Being the work of Archimedes, it was of course replete with curious and ingenious mechanical contrivances. Its interior arrangements, with which we are now chiefly concerned, have been thus described: "The middle deck had on each side of it fifteen apartments for dining, each furnished with four couches, such as they used to lie on at their meals, and on the same deck was also



SAFETY WATER COLUMN.

the place for the accommodation for the mariners, whereon were fifteen couches and three large chambers for men and their wives, each having three beds, next which was the kitchen for the poop, the floors of all which were paved with mosaic-work, wherein was represented the whole story of the Iliad, and suitable to so rich a floor was the workmanship of the ceiling and door to each apartment. On the upper deck was a place for exercise, and a fine walk, whereiu were several garden plots, furnished with plants of all kinds, which were watered by leaden pipes laid to them from a great receptacle of fresh water, where there were also several arbors of ivy and vines, set in hogsheads of earth, whose roots were watered in like manner as the plants." Were ever mariners so well housed and circumstanced as these? This brief extract from the description of the ship gives but a faint idea of its glories. There were cabins for the marine soldiers (they had marines in those far-distant days), and "twenty stables for horses" (horse marines also were apparently not unknown), and in the forecastle (what a glorious forecastle it must have been!) "was a receptacle for fresh water, made of planks, well lined with cloth and pitch, which held 253 hogsheads, and near that was a well, lined with sheet-lead, which, being kept full of sea water, nourished great numbers of fish."

This ship was too big for the shallow harbor of Syracuse, so Hieron sent her as a present to Ptolemy, surnamed Philopator, king of the Egyptians, and her name was changed from Syracuse to Alexandria.

The luxury of marine life is illustrated in this palace, with its baths, its sleeping-rooms, its couches, its banquet halls with all the devices that could be invented by the pleasure-loving, sensuous Greeks. It was all in keeping with the soft airs and smooth waters that kissed the purple hills of the Mediterranean and Ionian seas.—*Harper's Weekly.*

Manufacture in the South.

With the South making such phenomenal progress in nearly every line of manufacture, it is a matter of honest wonder to many what is to become of the things manufactured. For with all the increase in the South, there is no suspicion of falling off—but rather the contrary—in the North. The fact seems plain that, individually, the people in the country are using, year by year, more manufactured articles of every kind; wearing more shoes, more clothes, using more things into the manufacture of which iron and steel enter; in fact, in a hundred ways are using the products of the manufacturer.

The fact that the South can manufacture cheaply enough to sell in the North, furnishes a needed means of exchange, and encourages manufacture in both parts of the country. And the natural laws of competition—that great leveler—stimulates invention to the end of cheaping production, hence, bringing about increased consumption, the two things going hand in hand, as it were, to the greater comfort of the consumer.

The cry of over-production, except it may be in some special directions, is completely silenced by the logic of every-day events. What we want, and are getting, is increased consumption. With a well-paid and intelligent working population, it will be perfectly safe to give little heed to the talk of over-production for some generations; yet, what is a luxury to-day becomes the necessity of to-morrow, and this looking ahead will never cease—it never ought to cease. The prosperity of the South is the prosperity of the whole country, and the whole country will rejoice in it. Between different parts of this country there is only the question of where certain things can be done at the least cost of effort to those who do them. And this consideration will take care of itself.

We have, before this, referred to the good work that Mr. Valetin Geiselhart is doing for foundry apprentices in Albany, N. Y. Mr. Geiselhart, who is an experienced foundryman, brings a class to his own house, and spends his time in giving them instruction in the art. Recently he took his class on a day's trip to Troy, and found ready access to the steel and iron works there, the blast furnaces, the U. S. arsenal, and notable foundries. In a private letter he details to us the satisfaction of the young men at having explained to them things pertaining, more or less, to their life work.

The work that Mr. Geiselhart is doing will not pay him in dollars and cents, but no one could read his letter without knowing that he is getting paid in other ways, quite satisfactory to himself.

Signaling at Sea.

Some interesting experiments in new methods for signaling at sea are now being conducted on board the ships of the United States Navy. Since the development of the electric light it has been found easier, quicker and more certain to signal at night than in the daytime, besides reaching to a greater distance. Signal Officers Hughes and Hawk, of the flagships Philadelphia and Chicago, told a *Commercial* reporter the other day what was being done in this direction. The present day system of signaling is by the ordinary flag on a somewhat long staff or by the general signal code. This is not likely to be superseded, as it is only in night signaling, by means of the electric lights, that improvements are sought. The present system of night signaling is by three electric lights, green, red and white, of sixteen-candle power each, fitted in a vertical line on a jackstay, about six to eight feet apart They are worked by an ordinary telegraph key, one of the long line keys of the Western Union, to show them or shut them off, and the Morse code of telegraphing is used, showing the green light to mean a dash, the red light for a dot, all three lights briefly for a space, or all three for a more extended period to signify the end of a word.

The distance this system can be used depends somewhat upon the clearness of the night, but not generally beyond three miles. In fact, the distance is still experimental, but to communicate beyond three miles the Very system is used. This was devised by a navy captain named Very, has been in vogue a long time, and is generally satisfactory. It consists of pyrotechnical displays of red and green stars, by combinations of which certain numbers are represented, having their own signification in the code.

The new electric lighting systems have enlarged the sphere of signaling so much that a great deal is yet to be learned about it. The English navy system is a 32-candle-power light, called the "winking light." It is diverted to the desired ship and messages sent by disclosing or covering it with a shutter by an ordinary telegraph key. This can be worked very rapidly, and is clear for a distance of two miles, but the disadvantage it has is that it makes the signal only in one direction at a time.

Another system for long-distance signaling at present under experiment in our navy is to throw the electric search light directly overhead and make dashes and dots with it against the sky, so that they may be read for many miles by the whole fleet.

But a new French system, called the Ardois, has been fitted on the Chicago for experiment on her present cruise, and will be tested on favorable occasions, though the old system will always be resorted to in an emergency. This system is made up of ten lamps which hang vertically from a backstay, thus forming combinations which, being interpreted, make up the code. The combinations are worked from a keyboard having sixty-two different letters, signals, etc.

It is the system now in use in the French and German navies, but it is considered by American signal officers that it is doubtful whether it can be read at any great distance; besides which, the greater the number of lamps the greater the danger of confusion, and the more chance of some little thing going wrong just when it is most desired to work right, during dirty weather with everything wet. Almost any system will work satisfactorily in port, but at sea the conditions are very different, and what is wanted is something that will stand the practical test under adverse circumstances. The American officers will give them all a trial, however, and make careful reports of their observations to the department at Washington, with the probable result that new orders will be issued about signaling next year.

Another new feature on the squadron of evolution will be the application of a revised edition of naval tactics, which has been prepared by a board of officers, and is to be tried on the recommendation of Rear-Admiral Walker.—*Commercial Advertiser.*

Those who believe strikes are of modern origin are likely to be disabused by a recent article in *The Pall Mall Gazette*. According to accounts, strikes were extensively indulged in in Egypt 3,000 years ago. It appears that workmen in those times were paid at the beginning of the month, and their "blue Monday" lasted well into the month. Then they had a habit of striking to obtain the means of living. In the building of temples, King Pharaoh himself was sometimes appealed to, the workmen refusing to return to work until he had given his decision. These men appear to have been quite as obstinate as men of modern times, and generally made a "compromise," much as is done in these days. They appear to have had the habit of throwing down their tools on slight provocation, and assembling together to talk over their grievances. Sometimes efforts were made to prevent them leaving the buildings upon which they were at work, but these efforts do not appear to have been successful.

The French government has caused to be made several tests of gun steel at a low temperature—75° to 100° below zero, Fahrenheit. Part of the bars were hardened and part unhardened. The breaking load was increased by the cooling three per cent. in the instance of the unhardened bars, and six per cent. in that of those hardened. But in a shock, such as a gun would be subjected to, the unhardened bars, cooled, broke on an average with 5.9 blows against 14.6 blows under ordinary conditions. With the hardened bars the difference was less, 12.57 blows being required for the cold bars, against 14.4 at the normal temperature. The bars—both hardened and unhardened—had their elastic limit raised 11 per cent. by the cold, and their elongation was diminished by 12 to 14 per cent. The bars recovered their original properties upon attaining the ordinary temperature.

Under some conditions, sheet-zinc, when in direct contact with brick-work, suffers, as we described some years ago, to an appreciable extent from rapid corrosion. It has been found in the Berlin city market halls that a portion of the zinc-work supported upon brick walls was deeply pitted at a number of places, this being particularly the case where the metal was close to the bricks. Chemical examination of the bricks showed that they contained as much as 1.14 per cent. of soluble salts, capable of producing the destructive effect in question, and stimulated to more energetic action by moisture. The proportion of such salts, of course, varies with different kinds of bricks, while in some there may be nothing to induce any such corrosion. Lead also undergoes considerable changes in some lime mortar brick-work. —*London Engineer.*

Machinists' Supplies and Iron.

NEW YORK, January 24, 1891.

Iron—American Pig—There have been no new developments since our last report, the Thomas Iron Company not having yet announced their scale of prices for the year.

We quote No. 1 Foundry, standard Northern brands, $16.50 to $17.50; No. 2, $16 to $16.50; Gray Forge, $15 to $15.50; Southern brands No. 1 Foundry, $16.25 to $16.75; No. 2, $15.75 to $16; No. 3, $14.25 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $22.50, and Eglinton, $20.50.

Copper—The Lake companies have fixed their prices at 15 cents, and there are rumors of sales by outside parties at somewhat lower figures. Lake Ingot is held at 14½c. to 14¾c.; common casting brands 12c. to 12½c.

Lead—The demand for pig lead has fallen off, and the market is easy at somewhat lower prices. Values for car lots are at 4.50c. to 4.60c.

Spelter—The market has been dull and prices are mostly nominal. Values for round lots are at 5.40c. to 5½c.

Tin—The market continues dull. Jobbing prices are 20½c. to 20⅝c.

Antimony—The demand is very light, and little is being done in the way of trade.

We quote Hallett's, 16¾c. to 16⅞c.; Cookson's, 18½c. to 18¾c.

Lard Oil—The market is dull, but prices so far are maintained at 49½c. to 50c. for Prime.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Practical boiler maker wants a situation as foreman. Jas. E. Ross, 4064 Butterfield st., Chicago, Ill.

Wanted—A first-class mechanical draftsman. Address Clapp & Jones Mfg. Co., Hudson, N. Y.

Pattern maker wishes position in South or West; steady. Address Z, AMERICAN MACHINIST.

Machinists wanted; good lathe hands preferred; steady employment given. Ottumwa Iron Works, Ottumwa, Iowa.

Situation wanted by an expert steam, hot water, and general pipe fitter. F. Lynch, 48 Lewis street, New York City.

Wanted—One first-class instrument maker. Apply by letter to T. C. Mendenhall, Superintendent U. S. Coast and Geodetic Survey, Washington, D. C.

Situation wanted by prac. mach. and tool maker by March 1st; full knowledge of button hubs and dies, also insulator dies. F. G. Box 84, Breslau, N. Y.

Asst. superintendent wants position where he can design buildings, furnaces, machinery or systematize manufacturing; is draftsman and tool maker. G. A. H., AMERICAN MACHINIST.

Wanted—Steel stamp cutter, good general stamp hand, either as assistant or to take an interest, correspondence solicited. H. Barnard Rubber Stamp and Stencil Works, Hamilton, Ont., Canada.

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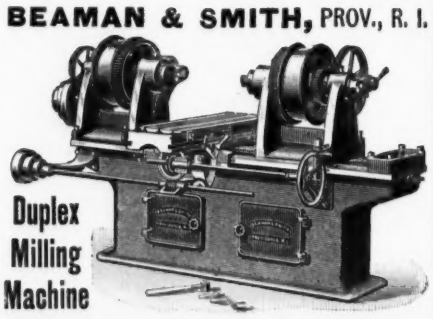
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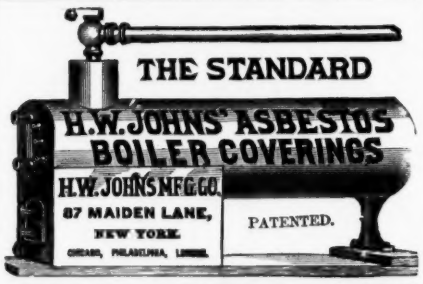

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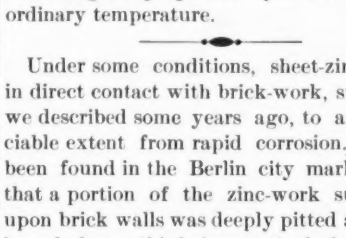
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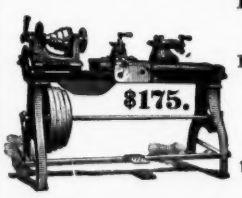

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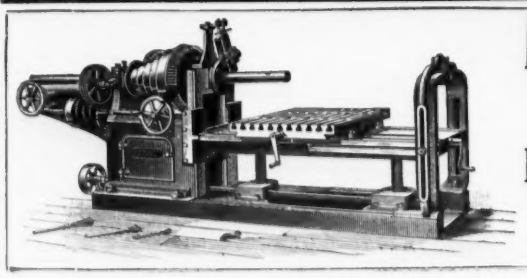
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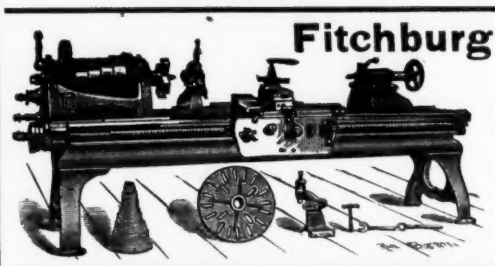

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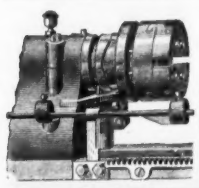
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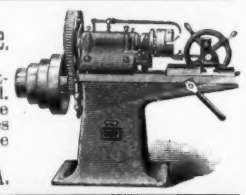

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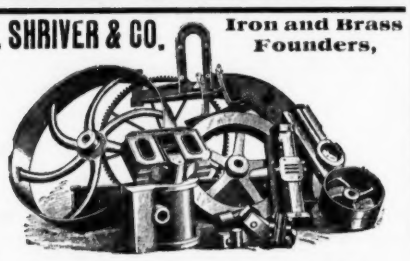
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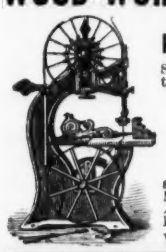
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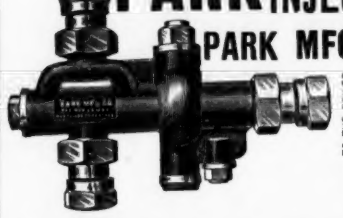

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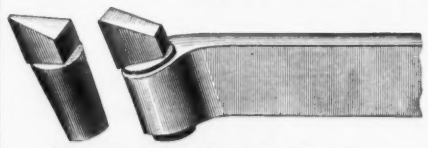
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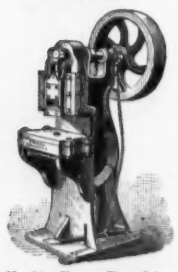
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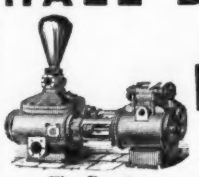
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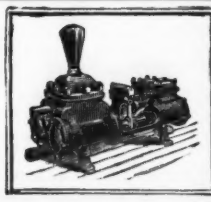
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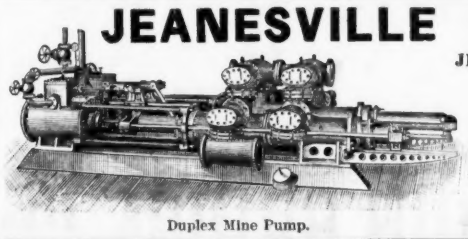
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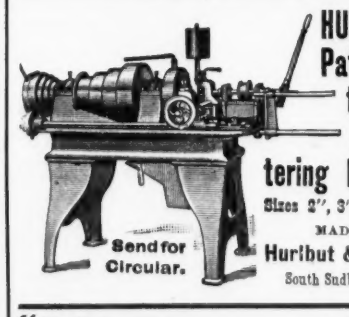
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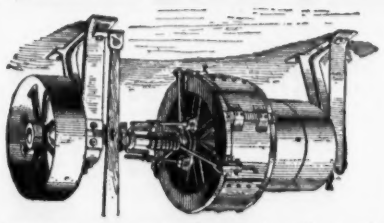
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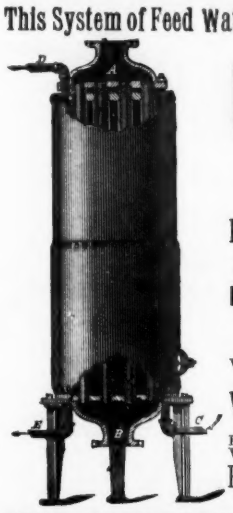

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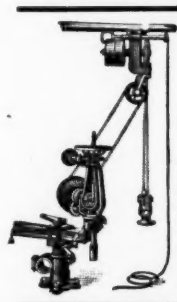

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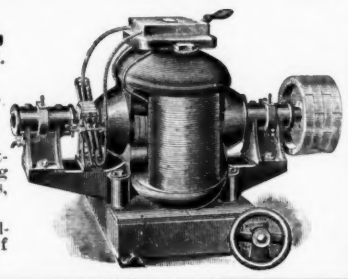

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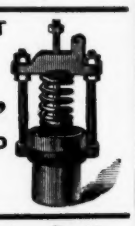

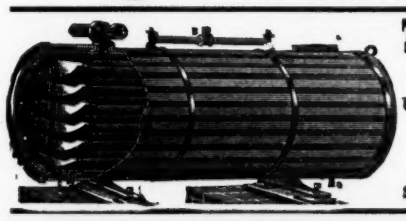

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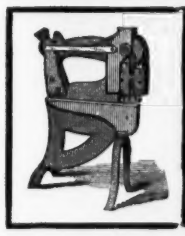

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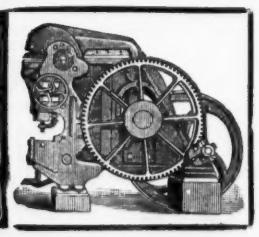

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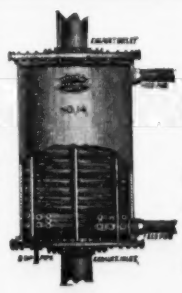

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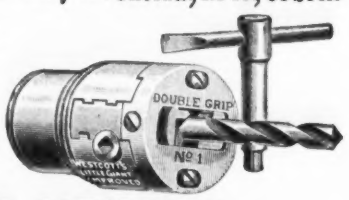

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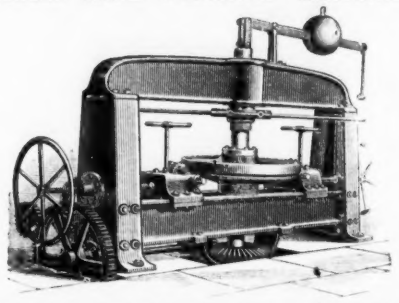

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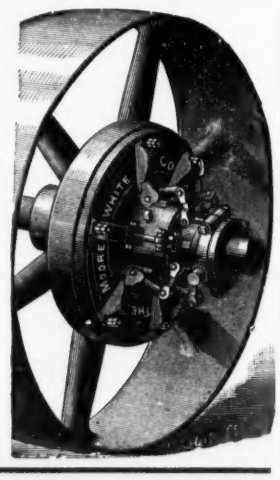

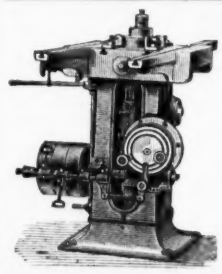

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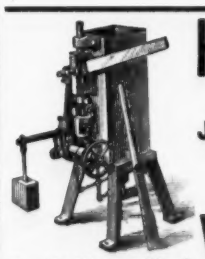

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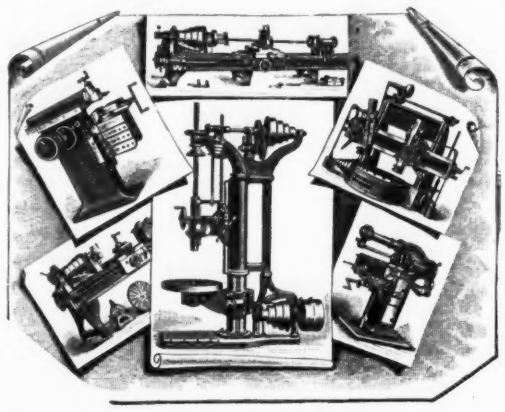

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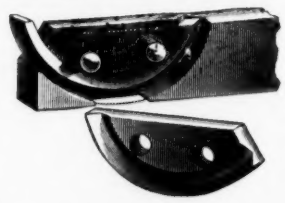

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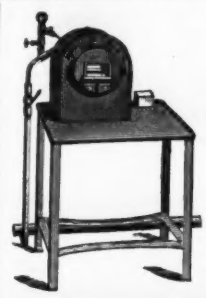

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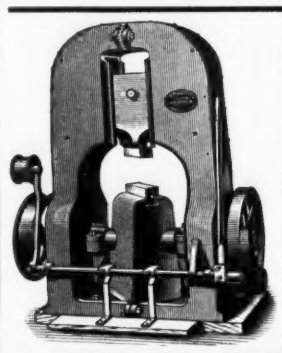

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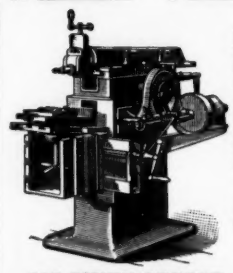

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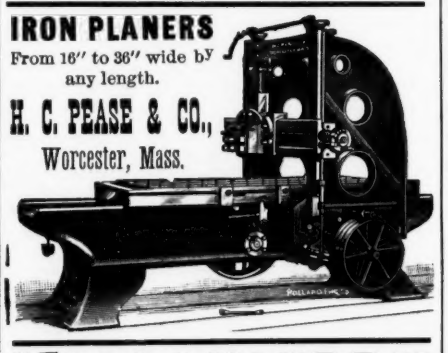

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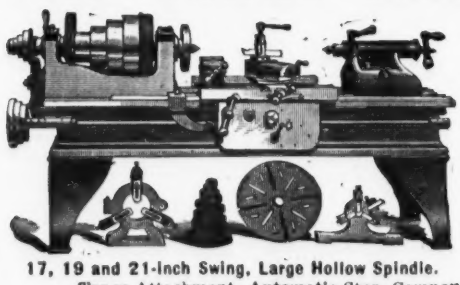

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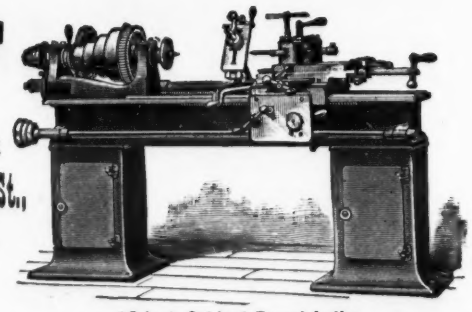

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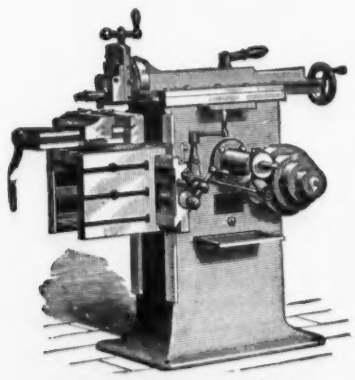

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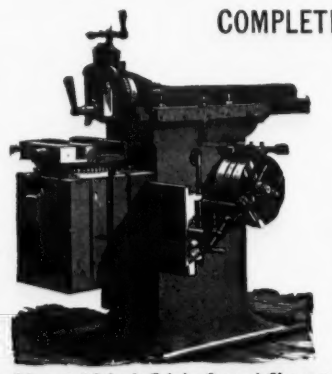
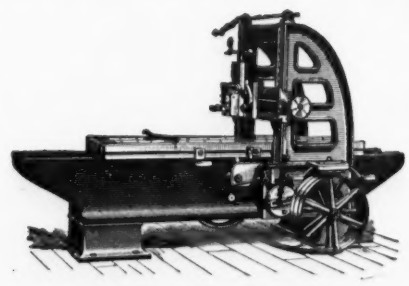


20, 26 and 32-inch Triple Geared Shapers.
Stroke changed while machine is running. Shaft can be passed through head of machine and key seat cut in same to any length. Extra heavy vises. Tables slotted on all sides.



24, 32 and 36-inch Planers.
Extra deep beds and tables. Powerfully geared. Plenty of Metal and designed for extra heavy duty. All Feeds and Shipper operated from both sides.
Improved Device for holding Planer Bolts.

DRILL PRESSES

MILLING MACHINES

IRON SHAPERS

25, 28, 32 and 40-inch Drills.
Automatic stop to feed. Quick return on right side. Table operated from front. Large cones and long belts.

NEW ENGLAND AGENTS,
THE C. & F. MACHINE TOOL CO., BOSTON, MASS.

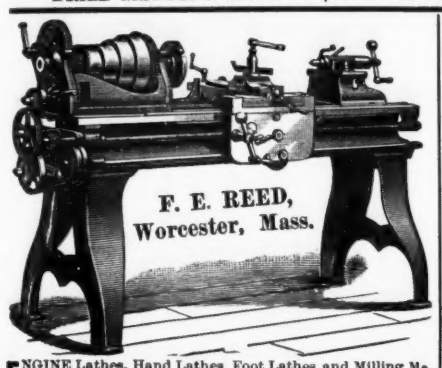
SOLE AGENTS FOR GREAT BRITAIN,
HERBERT & HUBBARD, COVENTRY, ENGLAND.

See advertisement on page 20.

MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass.

Manufacturers of Morse Patent Straight-Lip Increase Twist Drills.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.



ENGINE Lathes, Hand Lathes, Foot Lathes, and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

FLATHER ENGINE LATHES

14, 15, 16, 18, 20, 24 and 28 INCH SWING.
ANY LENGTH OF BED DESIRED.

HILL, CLARKE & CO.,
General Selling Agents,
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L. W. POND MACHINE CO.

Manufacturers of and Dealers in
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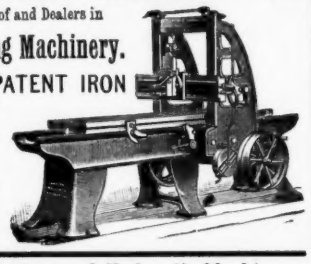
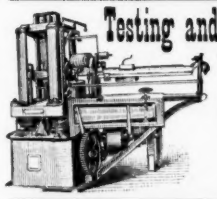
IMPROVED PATENT IRON PLANERS A SPECIALTY.
152 Union St., WORCESTER, MASS.





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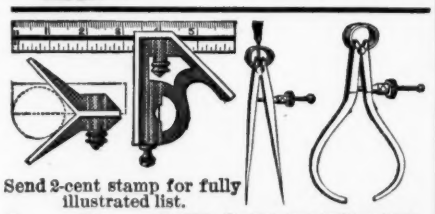
Novelty Patent Hand Drills.
TINIUS OLSEN & CO., MFRS.,
12th & Buttonwood Sts., PHILADELPHIA, PA.



Send 2-cent stamp for fully illustrated list.

L. S. STARRETT,

ATHOL, MASS.
Manufacturer of Fine Tools.

WILLIAM BARKER & CO.,

Manufacturers of
Iron and Brass Working
MACHINERY,
140 & 142 E. SIXTH ST.,
Near Culvert,
CINCINNATI, O.
Send for Circulars and Prices.

FOR
Substantial, Well Made, Low Priced, Patented,

20 Inch Drills,

With latest improvements, Lever, Combination or Wheel Feed, address
Sibley & Ware,
SOUTH BEND - INDIANA.

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OUTSIDE. No. 56 A. Price List.—Per pair.

3 inch.	$0.35	6 inch.	$0.65	10 inch.	$0.85
4 "	0.45	8 "	0.75	12 "	1.00
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Ideal and Leader Spring Dividers and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
Illustrated catalogue free to all.
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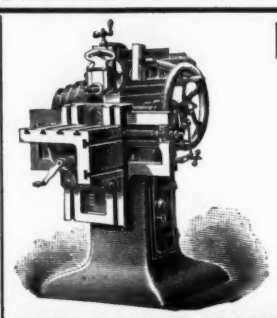

Lathes, Planers, Drills, Slotters, Etc.

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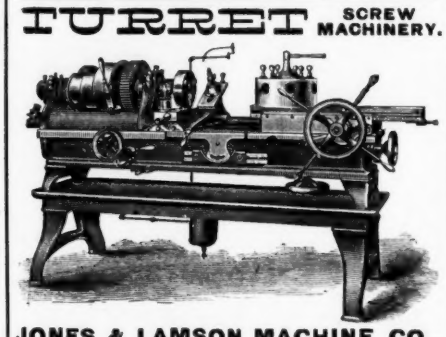
TURRET SCREW MACHINERY.



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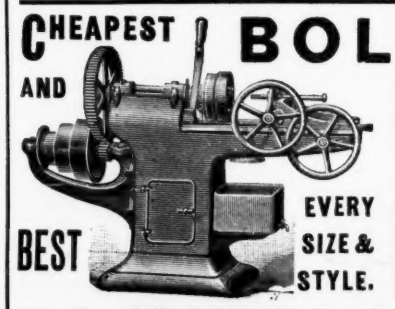

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H. B. BROWN & CO.,

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CURTIS & CURTIS,
66 Garden St., Bridgeport, Ct., U. S. A.
MANUFACTURERS OF
The Forbes Pat. Die Stock,
IMPROVED AND PERFECTED.
Pipe Cutting and Threading Machine, etc.
A portable cutting and threading machine with which one man can with ease thread pipe up to six inch diam. No vise is required.
SEND FOR ILLUSTRATED CATALOGUE.
Ratchet Drills, Ratchet Die Stocks and Malleable Iron Pipe Vises.

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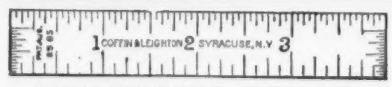
Machinists' Fine Tools
STANDARD TOOL CO., ATHOL, MASS.
SEND FOR NEW CATALOGUE



MACHINIST'S SCALES,
PATENT END GRADUATION
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

A NEW JAW
about once a year will make this Cutter last until you forget when you bought it, as the body never wears out.

Warranted to Cut Straight.

THE "EUREKA" PIPE CUTTER
IS THE BEST AND CHEAPEST MADE.

No. 1 Cuts	⅛ to 1 inch Pipe	$1.00	Nos. 1 and 3 will cut all sizes from ⅛ to 3 inch.
No. 2 "	¼ to 2 " "	1.50	
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Any Jobber can furnish this tool to you at these prices.

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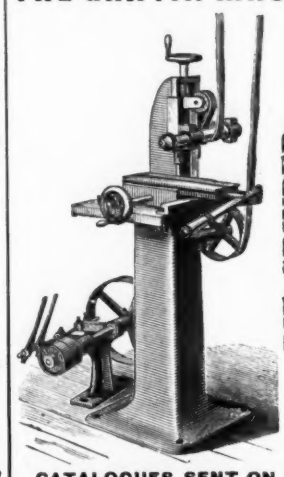

DIE GRINDER.
This is a very desirable and handy tool, designed particularly for use in connection with punch presses for grinding and sharpening dies, punches, etc.

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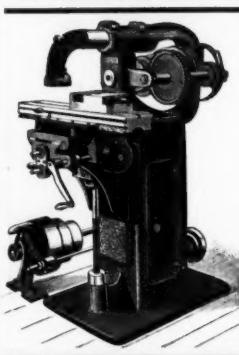
LAIGHT AND CANAL STS., N. Y. CITY.

CATALOGUES SENT ON APPLICATION.



Complete Universal Milling Machines.
Plain Back Geared Milling Machines.
Plain Universal Heads.

All designed to meet the requirements of the best practice.

KEMPSMITH Machine Tool Co.,
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NEW PATTERN!

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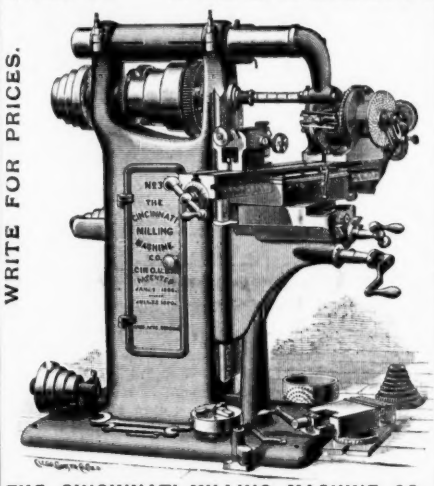
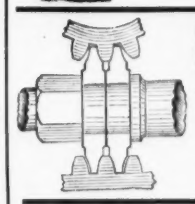


THE CINCINNATI MILLING MACHINE CO.,
SECOND & PLUM STS. CINCINNATI, O.

Manufacturers of
Machinists' Tools,
WORCESTER, MASS.



CLOUGH'S PATENT DUPLEX GEAR CUTTER

One pair of these Cutters cuts a pitch of interchangeable gear wheels from 15 teeth to a rack inclusive.
For circular and prices, address
R. M. CLOUGH,
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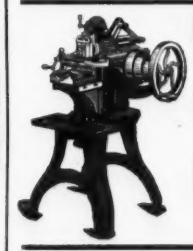

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WORCESTER, MASS.
Manufacturers of
Shaping Machines, Drilling Machines, Bolt Cutting Machines.

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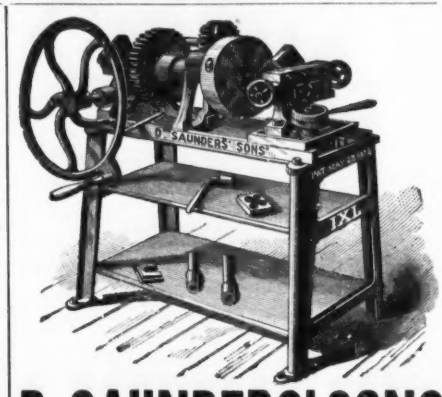
20 to 42 inch swing, with both worm and lever feed, self-feed and back-geared.
Barnes' Patent Friction Driver. Sensitive Drill. Single and Multiple Spindle.
Barnes' Patent Engine Lathe.
15 inch swing, 6 foot or 8 foot bed.
They have advantages not found in other machines in this line. It will pay parties desiring to purchase or know more about these machines to send for full description and prices to
W. F. & JOHN BARNES CO.,
ROCKFORD ILL.
Address No. 1995 Ruby St.



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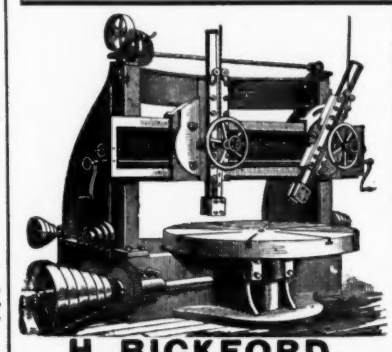
MANUFACTURERS OF THE ORIGINAL
TRADE **I. X. L.** MARK.
PIPE CUTTING & THREADING MACHINE.
BEWARE OF IMITATIONS.
None genuine without our Trade-Mark and Name.
Steam and Gas Fitters' Hand Tools. Pipe Cutting and Threading Machines for Pipe Mill use a specialty.
Send for Circular. **21 Atherton St., YONKERS, N. Y.**



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4, 5 and 6 Ft. SWING.

PRENTICE BROS.,
Manufacturers of
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Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world.
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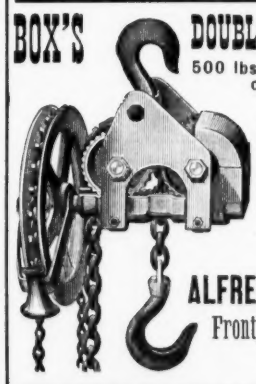
BOX'S DOUBLE SCREW HOIST,
500 lbs. to 20 Tons Capacity carried in Stock.



Full line of Cranes usually in course of erection, from the small single track and trolley, to 50-ton Traveling and Jib Cranes. Radial Drills for Machine Shop use. Special Radials for Bridge Builders.

Photos and Cuts on Application.

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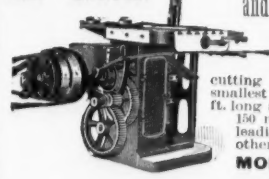
CAUTION

Any Key Seat Cutter with a tool connected to a reciprocating head and made adjustable towards and from the work, and having a vise in which a Key may be fastened in proper position to be cut, infringes claim 8, 9, 16, 17 and 18 of our Morton Patent No. 375,680, of Nov. 22d, 1887.

THE MORTON Lightning Key-Way Cutter and Key Maker,



Portable Key-Way Cutters and Portable Planers a specialty ranging in size and cutting capacity from the smallest work to key-ways 5 ft. long and 6 ins. wide. Over 150 machines in use in the leading shops of this and other countries.
MORTON MFG. CO.,
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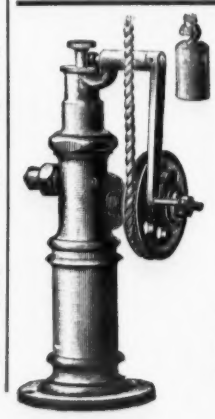
"We have no machine in our works of same cost that earns as much money as yours." EDW. P. ALLIS & Co.
Edwin Reynolds, Supt.



Damper Regulators.

Ours is the Simplest, Cheapest and Best.

Price, $60 and $100.

Each Machine Nickel Plated.

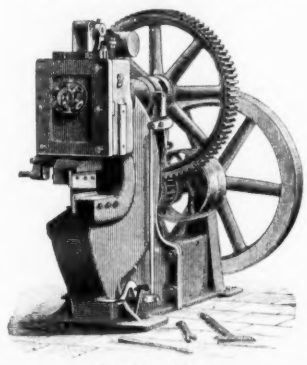
Only Two Connections Necessary.

Weight 15 and 30 lbs.

Mason Regulator Co.,
BOSTON.

WILLIAM SELLERS & CO., Incorporated.
PHILADELPHIA, PA.
BUILDERS OF
MACHINE TOOLS FOR WORKING IRON AND STEEL
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.

THE LONG & ALLSTATTER CO.,
HAMILTON, OHIO.
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple Belt and Steam Driven
PUNCHES AND SHEARS,
OVER 300 SIZES.
ALSO
POWER CUSHIONED HAMMER.
SEND FOR NEW CATALOGUE.



Bar Iron Shear.

ESTABLISHED 1842
ROBERT POOLE & SON CO.
ENGINEERS AND MACHINISTS.
MACHINE MOULDED GEARING.
ALL KINDS OF TRANSMISSION MACHINERY
OF THE HEAVIEST CLASS.
BALTIMORE, MD.

THE OPEN SIDE IRON PLANERS.

Office of SANDY HILL IRON AND BRASS WORKS,
SANDY HILL, N. Y.,
January 5th 1891.

THE DETRICK & HARVEY MACHINE CO.:

The "D" size Open Side Planer with Supplemental Table to plane 12' long, which we purchased of you in October last, is working to our satisfaction. It is a superb tool. We are rushing work through this machine at a rate surprising to us. We consider it the most valuable addition to our shops.

Wishing you a successful year, we are, yours very truly,
SANDY HILL IRON AND BRASS WORKS.

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ACME MACHINERY CO.
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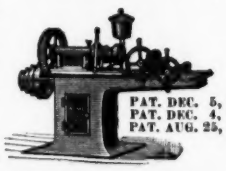
Manufacturers of
ACME BOLT & RIVET HEADERS,
Acme Single & Double Automatic BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.



PAT. DEC. 5, 1882
PAT. DEC. 4, 1883
PAT. AUG. 25, 1885

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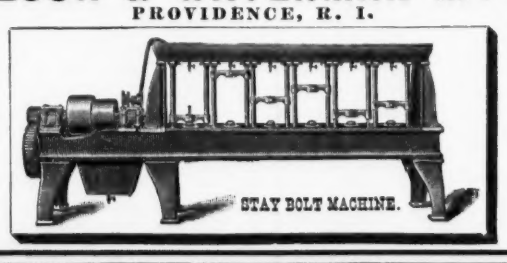
LATHES.
CUTTING-OFF MACHINES,
TRAVERSE DRILLS,
TRAVERSE BORING MACHINES,
SPECIALS,
&c., &c.



STAY BOLT MACHINE.

BOLT & NUT MACHINERY
BROACHING MACHINES,
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BOLT LATHES,
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ALL GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS.
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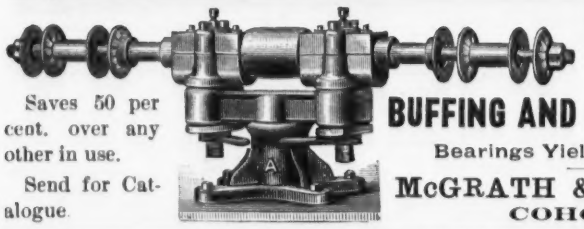
PHOSPHOR-BRONZE
INGOTS, CASTINGS & MANUFACTURES.
THE PHOSPHOR BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.



Saves 50 per cent. over any other in use.

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McGRATH'S PATENT
BUFFING AND POLISHING LATHES
Bearings Yielding or Rigid at Will.
McGRATH & COLLINS, Mfrs.
COHOES, N. Y.

THE INDISPENSABLE LATHE DOG.

One Set of 3 does the work of 12 common dogs.
No. 1, ¼" to 1¼"; No. 2, ½" to 2¼"; No. 3, 1" to 3¼".
$7.50 Per Set.
These DOGS can be attached after the work is centered in the Lathe.
Ask your dealer for them; if he have not them in stock send to us direct.
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607 Market St., PHILADELPHIA, PA.

BEMENT, MILES & CO.,
PHILADELPHIA, PA.,
BUILDERS OF
METAL-WORKING MACHINE TOOLS,
FOR
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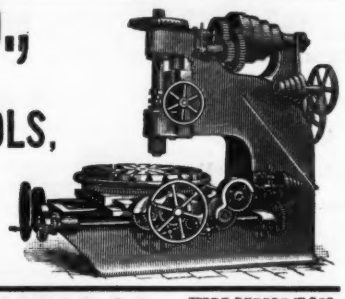
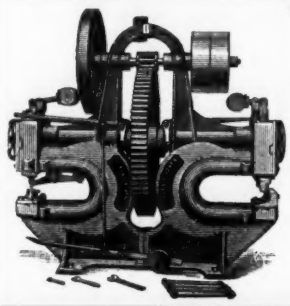
LOCOMOTIVE AND CAR BUILDERS,
MACHINE SHOPS, ROLLING MILLS,
STEAM FORGES, SHIP YARDS,
BOILER SHOPS, BRIDGE WORKS, ETC.





The HILLES & JONES CO., WILMINGTON, DEL.
MANUFACTURERS OF
PUNCHES AND SHEARS,
All Designs and Sizes,
AND A FULL LINE OF
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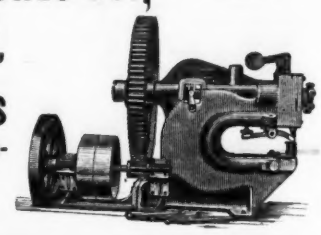
FOR
Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, etc., etc.



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DROP FORGINGS.

RITTENHOUSE PATENT ADJUSTABLE GUIDE AND SPACING TABLE.

FOR THE USE OF BOILER MAKERS
Or other Structural Iron Workers.
Designed for either straight or curved work.
Prices and descriptive circular sent upon application.
C. RITTENHOUSE & SONS,
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ROYLE MACHINE WORKS,
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SECOND-HAND TOOLS FOR SALE.

No. 4½ Schlenkler Bolt Cutter (old style). Countershaft. Tapping Attachments. Dies ⅜" to 1¾" by 8ths.
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Pratt & Whitney Double Bolt Cutter with National Heads. Dies to 1⅜".
Sellers' Bolt Cutter. Countershaft. Cuts to 1½".
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3-Spindle National Belt Nut Tapper.
P. P. Bush & Co. 12" Crank Planer. Countershaft.
Durfee & Doe Key Seating Machine.
No. 2 National Washer Machine. For Bolts 1" and under.
No. 2 Pittsburgh Nut Machine, for ¼" to ¾" nuts.
Cold Rod Upsetter. For ⅝" and under Cold Steel Rods.
New Washer Machine. For Washers up to 1" Bolts
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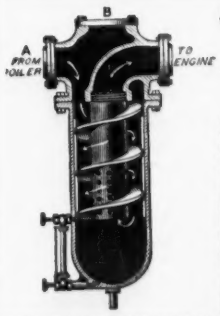

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For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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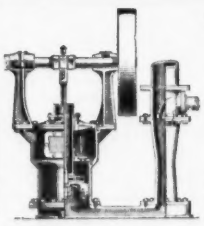

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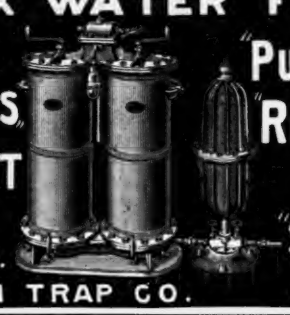

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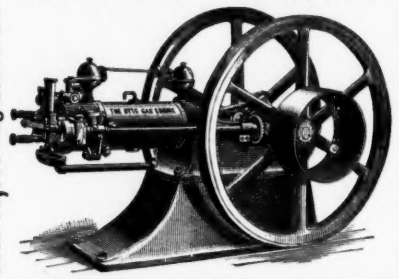

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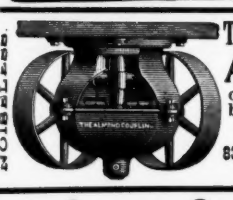

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A NEW quarter turn motion to replace quarter turn belts and bevel gears.

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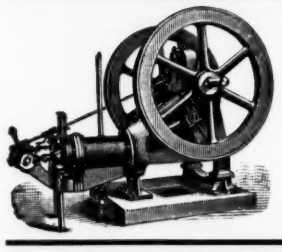

Four strokes of piston in one revolution of crank-shaft, expanding the charge to more than the original volume, driving out *all* the products of combustion, and giving a working stroke at every revolution and in half the time required by any other engine. *Send for Illustrated Circular.*

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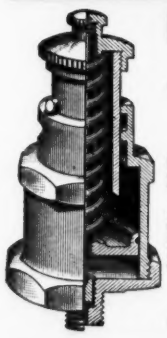

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IN STOCK.

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Prentice "	"	12 in. x 5 ft., 16 in. x 8 ft., 18 in. x 8 ft.
Lathe & Morse Eng. Lathes,	16 in. x 6 ft.,	20 in. x 10 ft., 37 in. x 12 ft.
Hendey Engine Lathes,	14 in. x 6 ft.,	16 in. x 6 ft., 18 in. x 6 ft., taper attachment.
Hendey Engine Lathes,	14 in. x 6 ft.,	16 in. x 8 ft., plain.
Wright "	"	16 in. x 6 ft., 18 in. x 8 ft., 24 in. x 12 ft.
Perkins "	"	16 in. x 8 ft., hollow spindle 1 1 8.
Fay & Scott "	"	32 in. x 16 ft.
McMahon "	"	16 in. x 8 ft. Heavy pattern.
Fitchburg Planers,	24 in. x 6 ft.,	25 in. x 8 ft.
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Prentice Drill,	20 in. Comb Wheel and Lever Feed.	
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" "	20-25-32 and 36 in. complete.	
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Brass Lathes, Turret and Square Arbor, all sizes.		
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SECOND-HAND. (*Low Prices.*)

Engine Lathe,	25 in. swing,	10 ft. bed,		fair order.
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" "	20 in. "	6 ft. "		cheap, fair order.
" "	19 in. "	8 ft. "		good order.
" "	18 in. "	6 ft. "		cheap, fair order.
" "	16 in. "	7 ft. "		modern, A 1 order.
" "	15 in. "	5 ft. "		good order.
" "	13 in. "	6 ft. "		cheap, fair.
Planer, 24 in. x 7 ft., Pond Mch. Tool Co.,				modern, good as new.
Planer, 32 in. x 12 ft., New Haven,				cheap, fair order.
" 48 in. x 11 ft.,				Heavy pattern, good order.
Shaper, 24 in., Hendey, Friction				"

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FOR LIGHT, SENSITIVE AND RAPID DRILLING.

1, 2, 3, 4 or more Spindles, Sensitive or Automatic Feed.

To drill from 0 to 1-2 inch holes.

The *Latest* and *Best*; most convenient, sensitive and durable Drill on the market.

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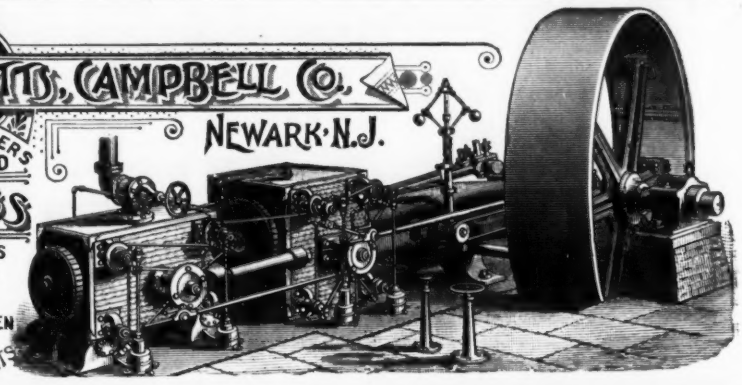

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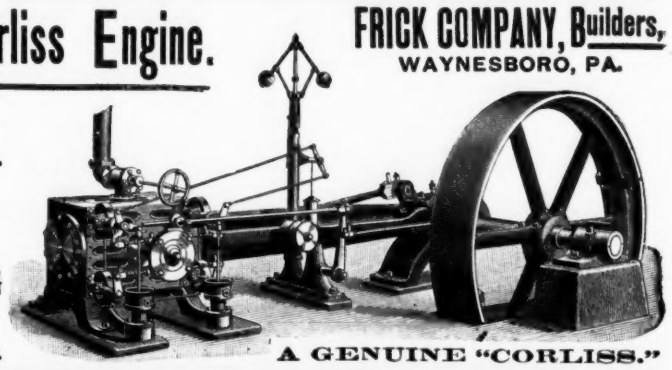

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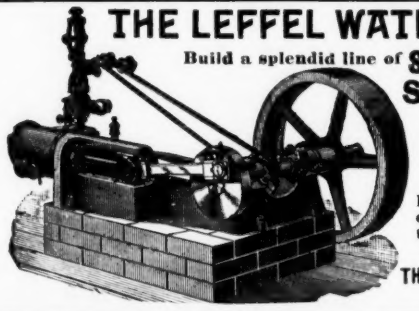

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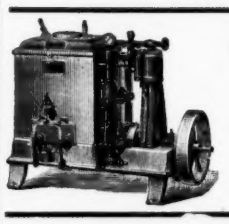

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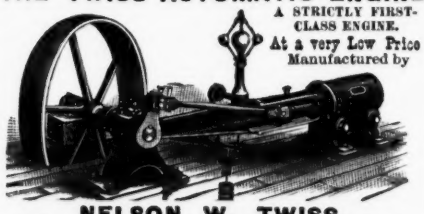

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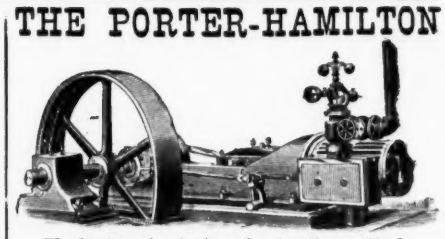

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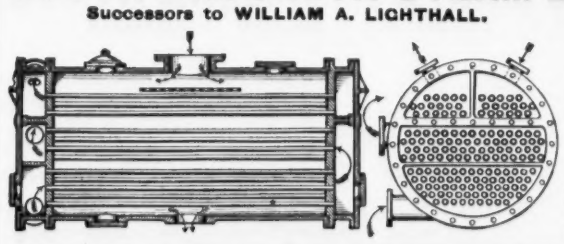

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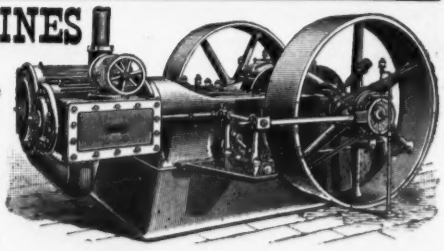

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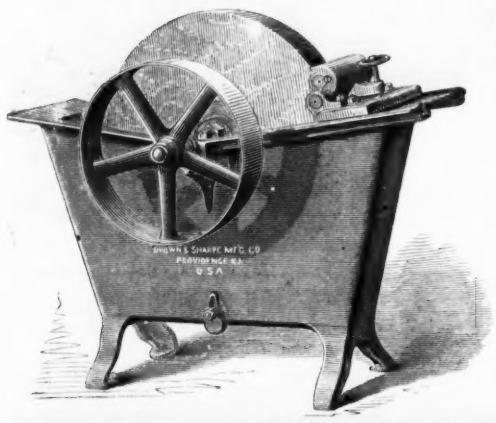

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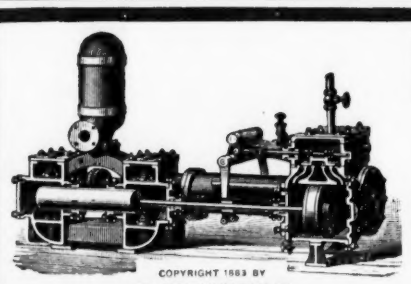

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N. B.—See "Advertisement", page 16.

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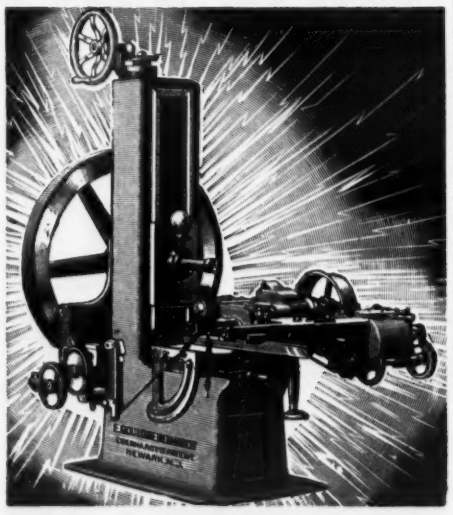

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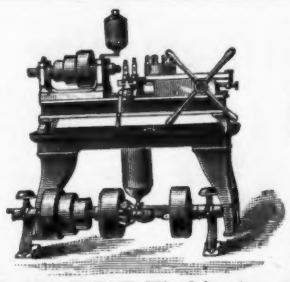

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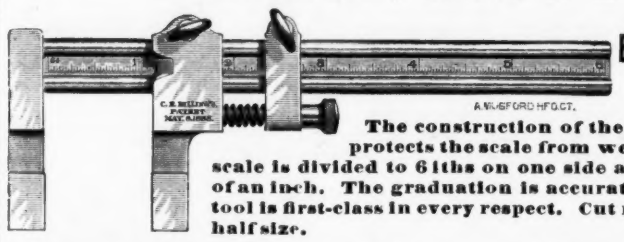

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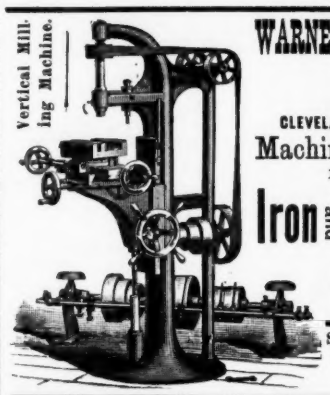

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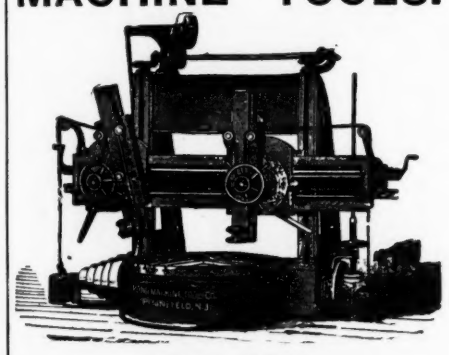

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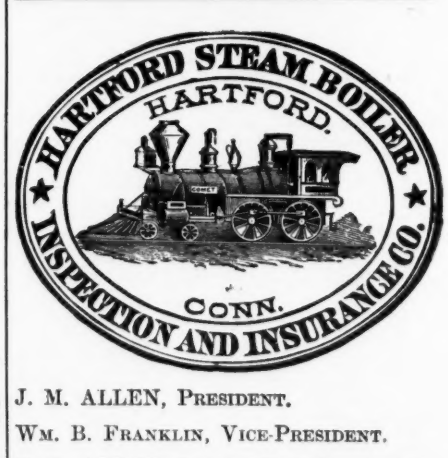

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